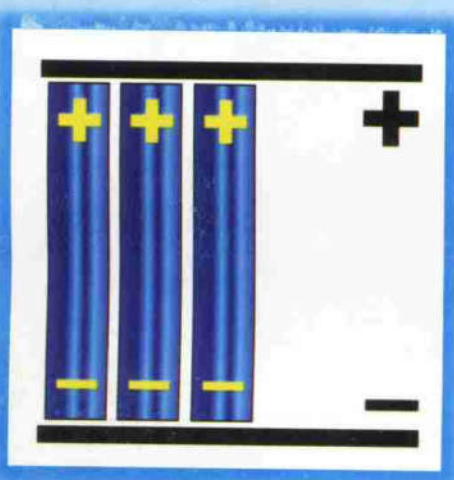
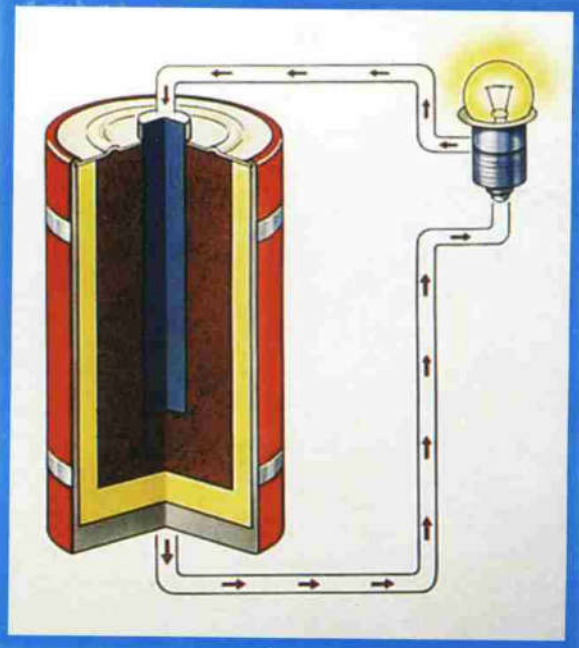
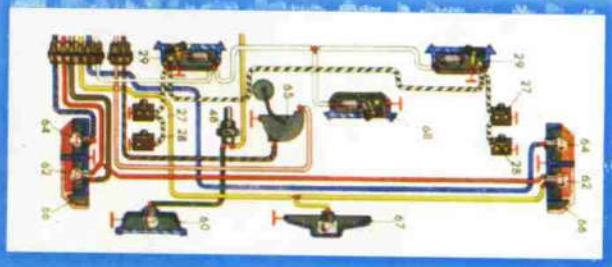
TECHNICAL DRAWING
ELECTRICIAN GENERAL 1







Revised Edition

Price Rs. 40/-

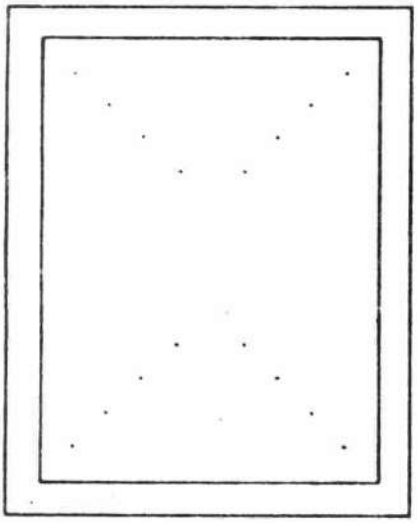
TEVTA

GOVERNMENT OF THE PUNJAB
TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY
TRADE TESTING CELL, LAHORE.

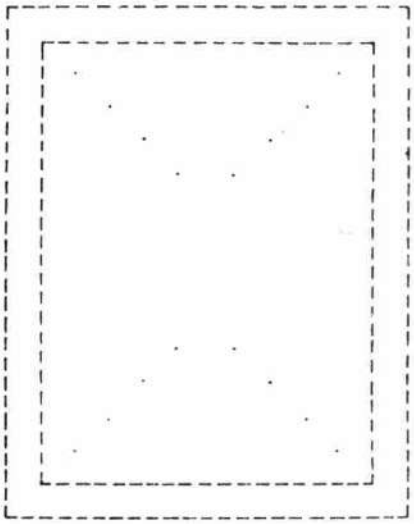
TTP

T.T.P. Series No.4

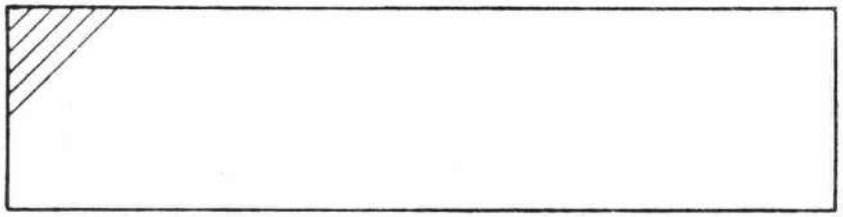
Visible outlines



Invisible outlines



Section lining



Centre lines

Thickness of Lines

0,5 mm: visible outlines
0,3 mm: invisible edges
0,2 mm: centre lines,
dimension lines

Drawing Instruments

pencil No. HB and H
ruler (30 cm, mm-scale)
square set (45° and 60°)
rubber, pencil sharpener

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Technical Drawing No. 1

I	H
L	E
F	T
N	M
K	V
W	X
Y	Z
A	J
U	P
R	B
D	C
O	Q
G	S
1	7
4	0
6	9
2	5
3	8

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

k	v
w	x
z	j
y	l
t	tt
f	r
n	h
m	u
c	a
d	q
g	o
p	b
e	s

Drawing No 2

Lettering Exercises

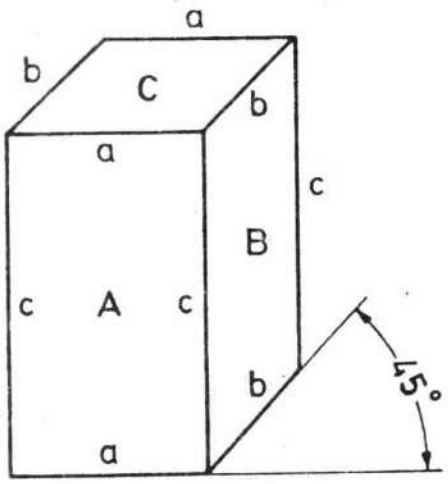
Standard : DIN 17

1st Semester

Material : St 37

Scale 1 : 2,5

Sketching from Models



The rectangular prism (a= 30 mm, b= 40 mm, c= 50 mm) is printed in cavalier projection.

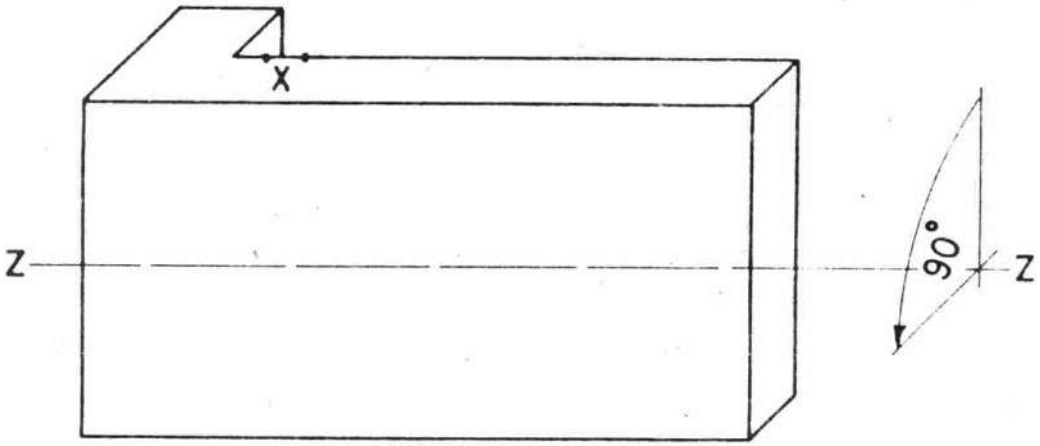
Area "A" is represented true to size and shape.

The third dimension is shown under an angle of 45°. The length of "b" is half that of the natural size.

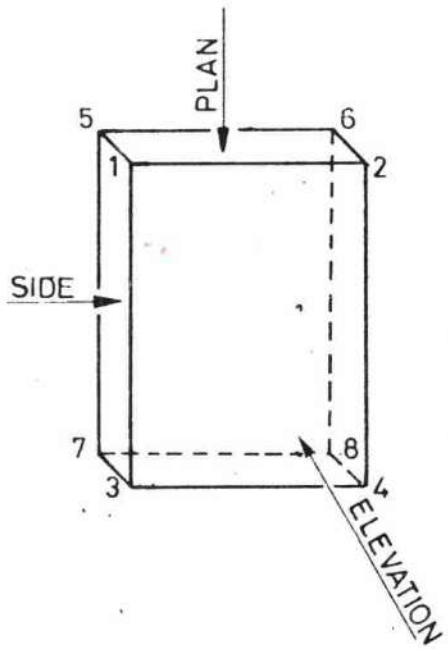
The areas "B" and "C" appear distorted.

Exercise: Draw the cavalier projection of a flat (60 mm x 20 mm x 200 mm). The cross-section (60 x 20) should be parallel to the picture.

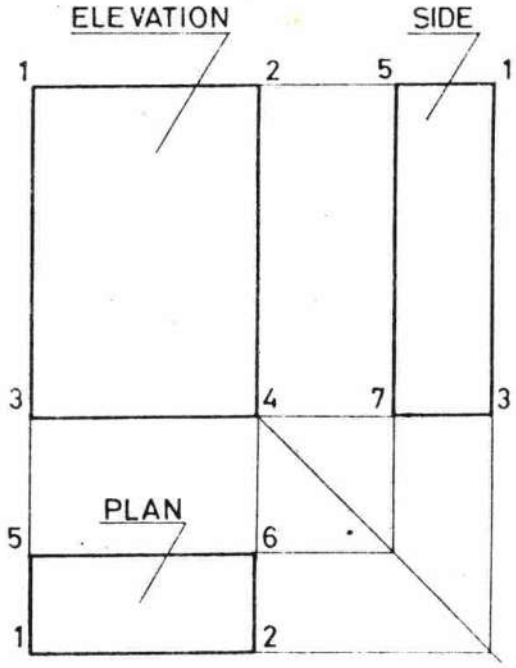
L



Draw the cavalier projection of the clamp part.
Area "x" shall be parallel to the picture plane.



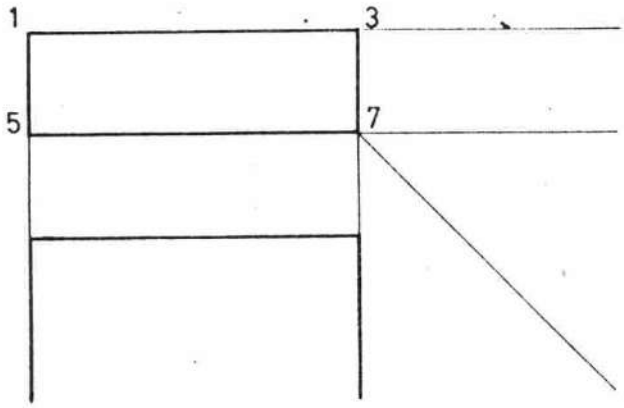
Lengths 1-5 and 2-6 are half those of the true size.



In engineering drawings the true shapes and sizes of the various surfaces have to be shown.

Exercise: Draw the side and plan views of the above object, the elevation being chosen as shown below.

Mark the visible corners in all three views with the corresponding numbers.



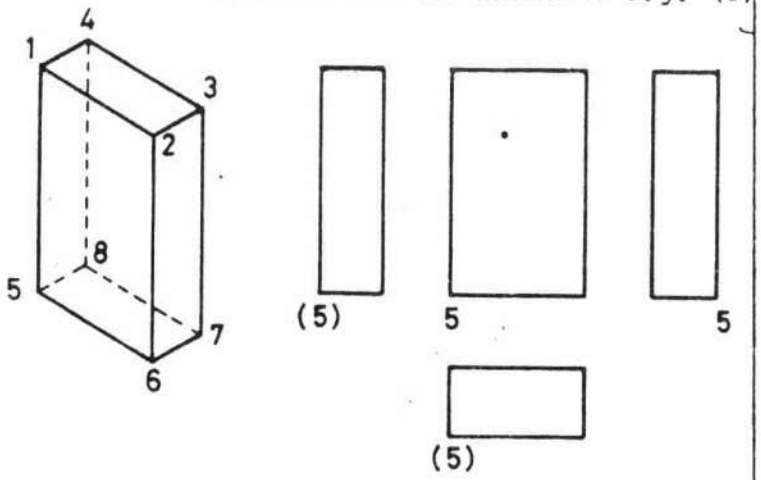
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

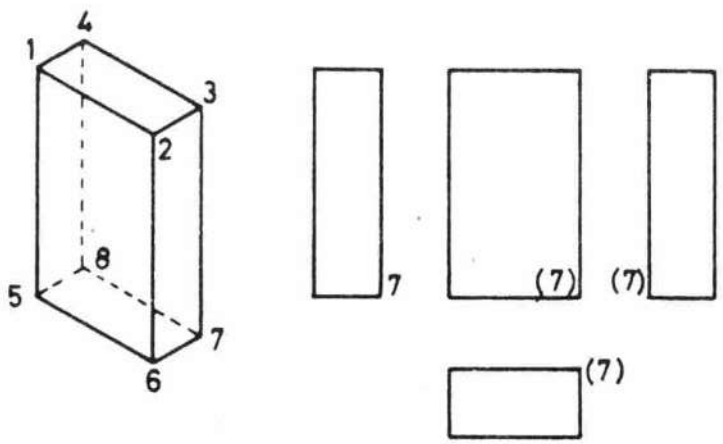
Technical Drawing No. 7

Finding corners

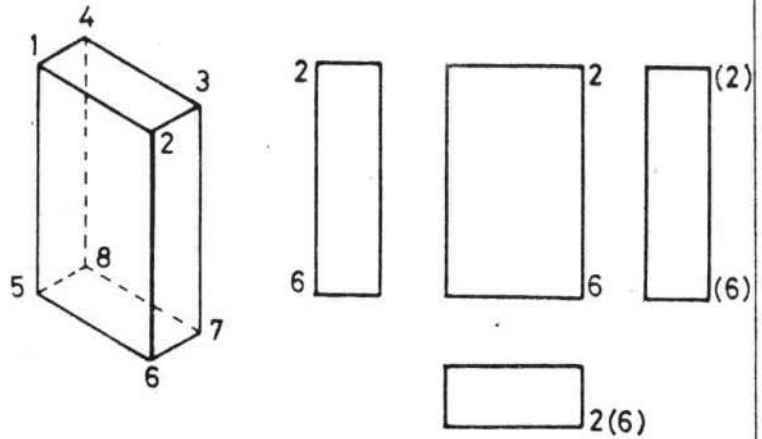
invisible corners are in brackets e.g. (5)



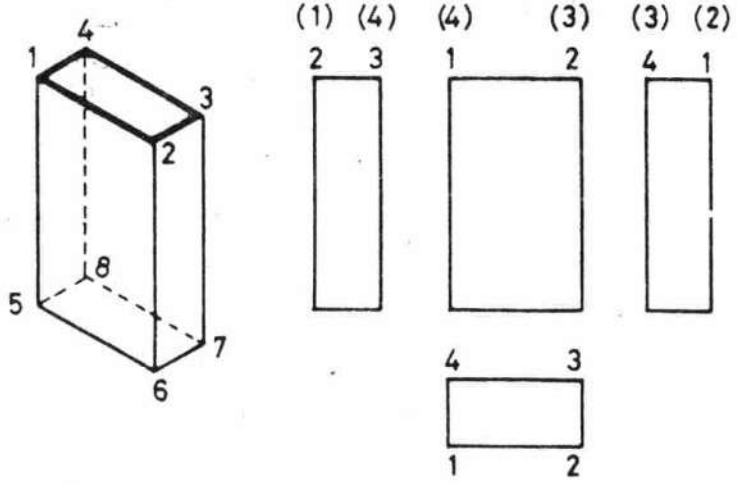
Finding corners



Finding edges



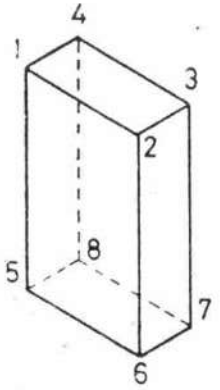
Finding surfaces



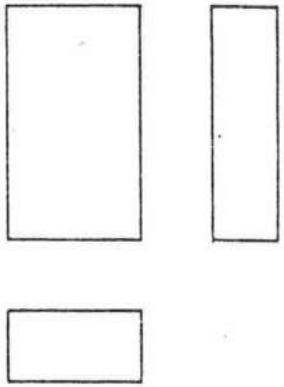
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

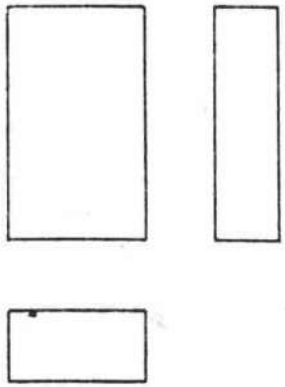
Technical Drawing No. 8



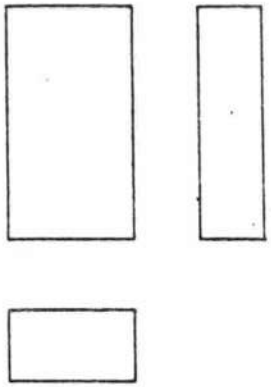
Transfer corners 1 and 7 into the three views!

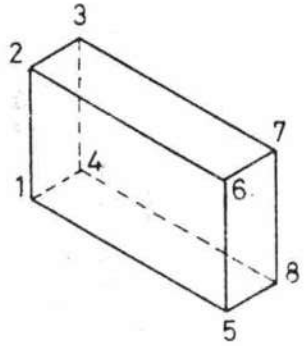


Transfer edge 5-6 into the three views!

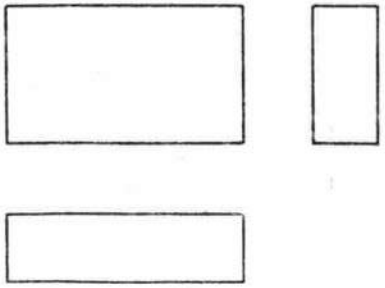


Transfer surface 2-3-7-6 into the three views!

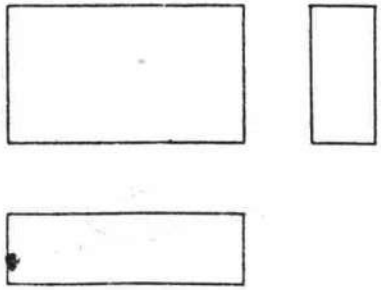




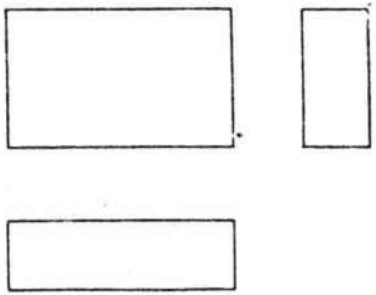
Transter corners 5 and 6 into the views!



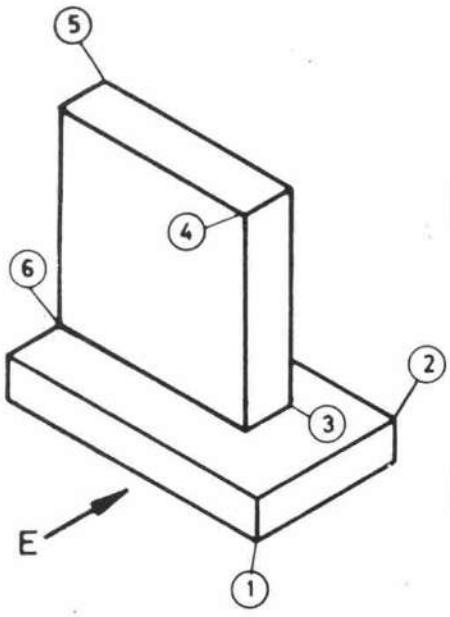
Transfer edge 3-4 into the views!

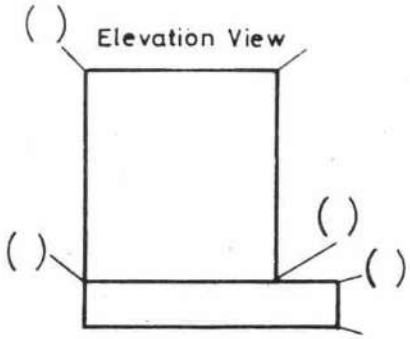


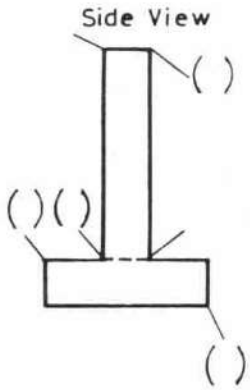
Transfer surface 1-2-3-4 into the views!

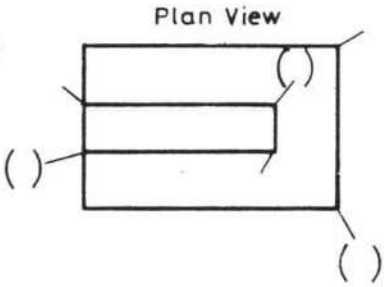


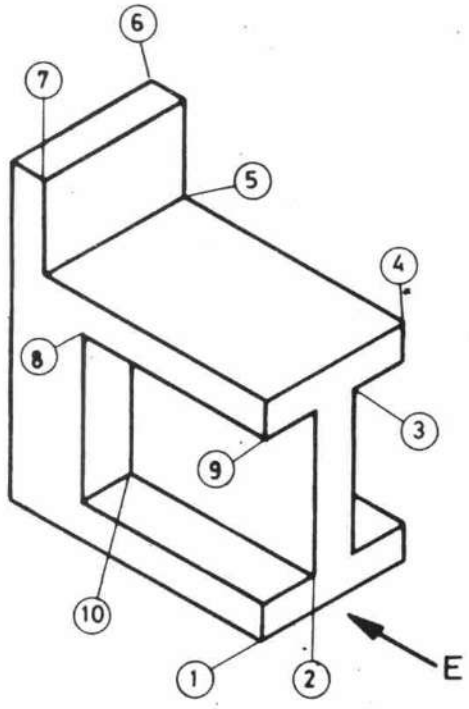
ENTER THE CORRECT NUMBERS

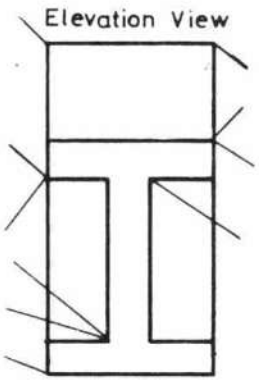


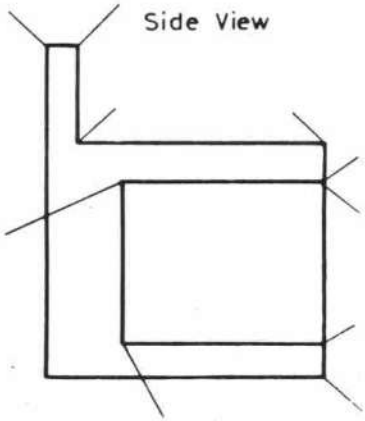


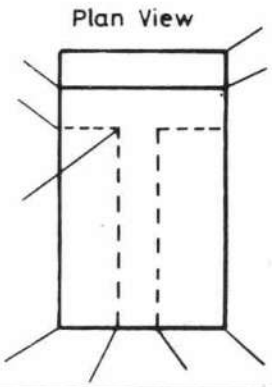








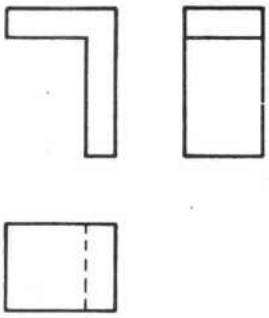


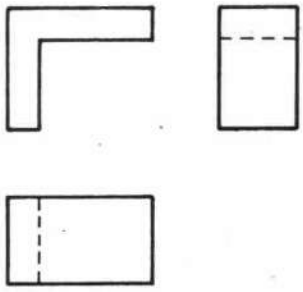


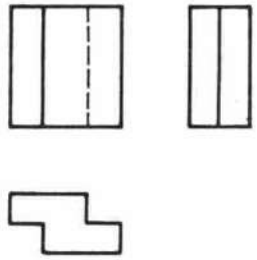
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

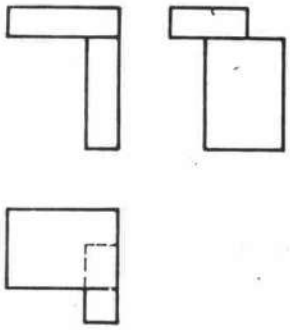
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

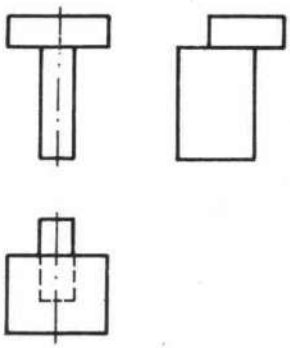
Technical Drawing
No. 9

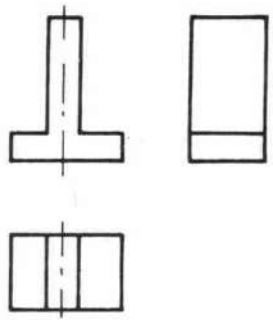

1

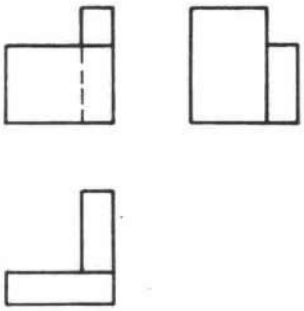

2

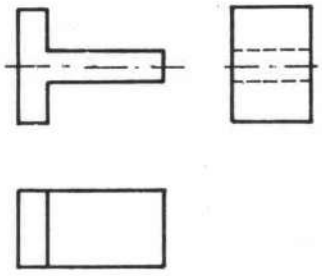

3

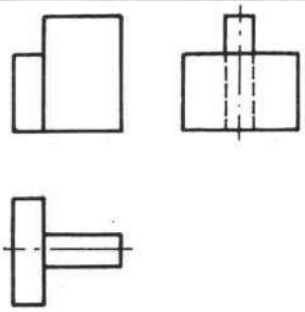

4

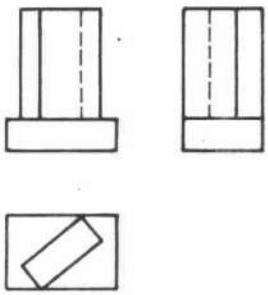

5


6


7


8


9

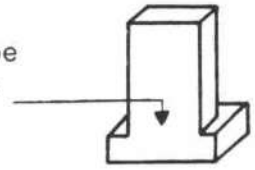

10

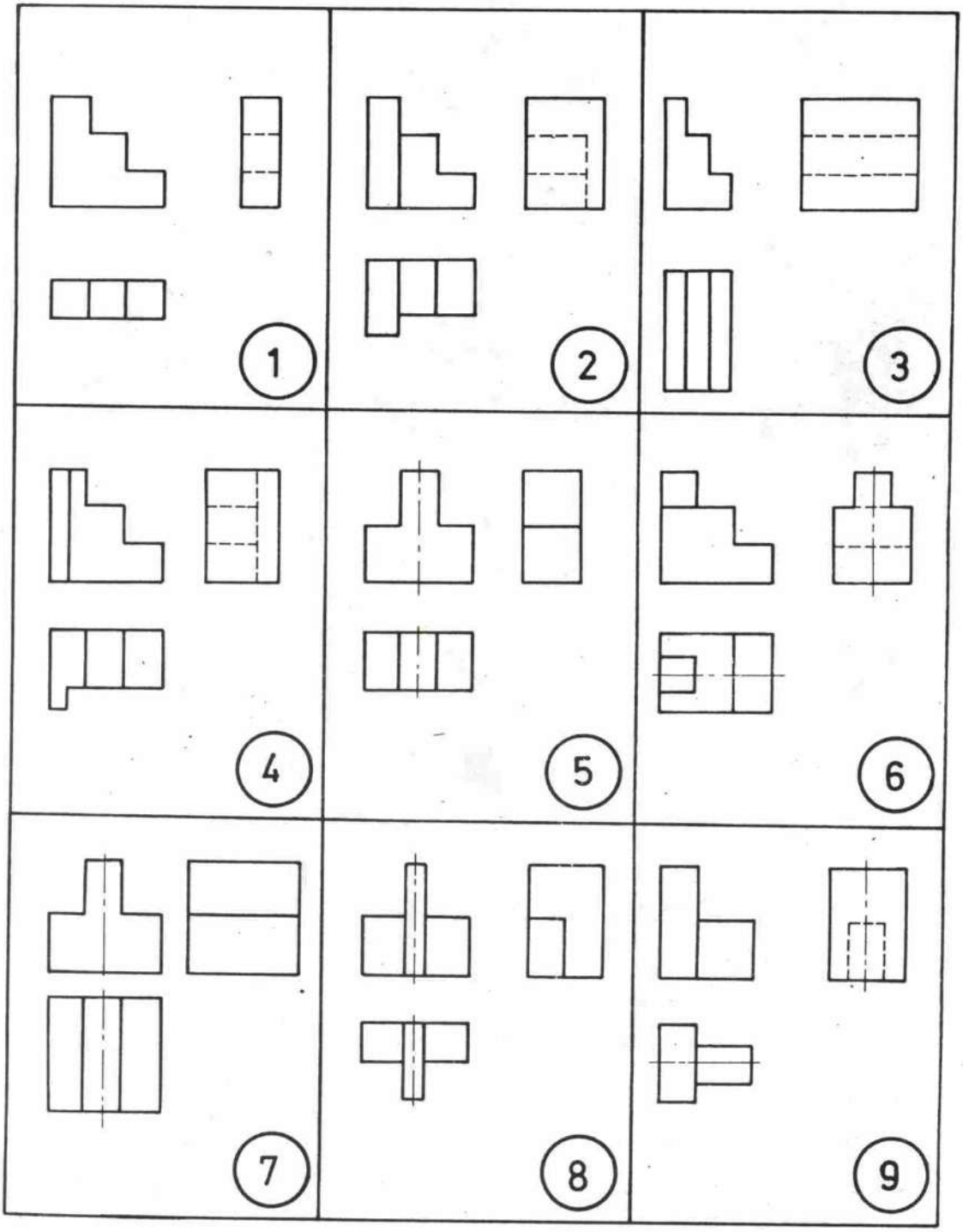
Build each body shown from two equal wooden blocks or matchboxes.

Place it in front of you in a way that the elevation is directed to you.

The assembled body is to be considered <u>one</u> solid part.

Therefore, no edge here!



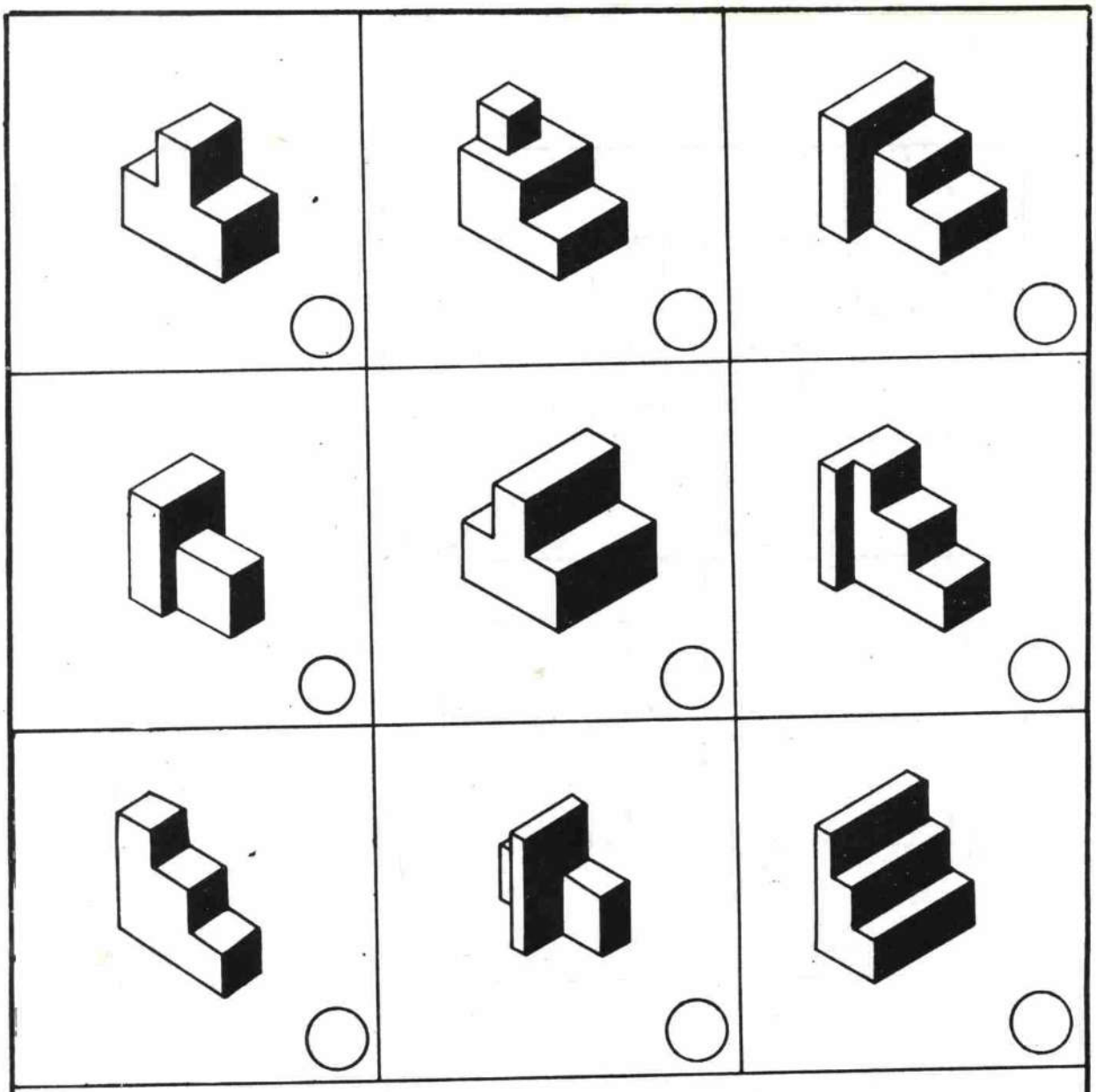


DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Technical Drawing

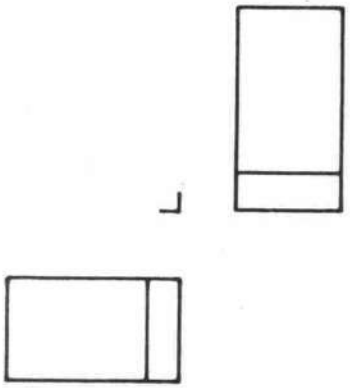
No. 11

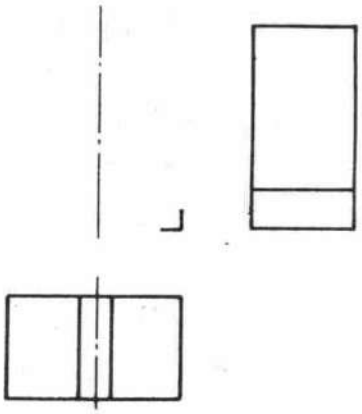


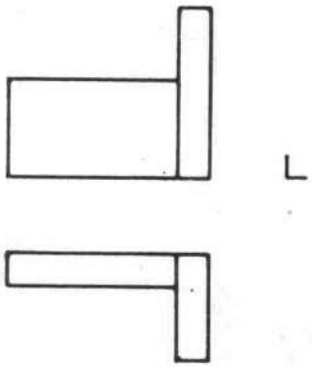
Sheet No. 11 shows nine three-view drawings. Each of these corresponds to one body shown above.

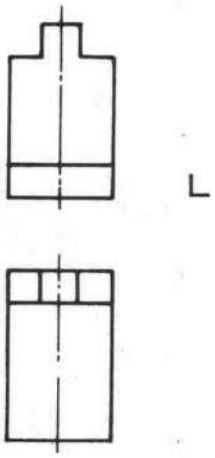
Enter the right number of the three-view drawing into the circle.

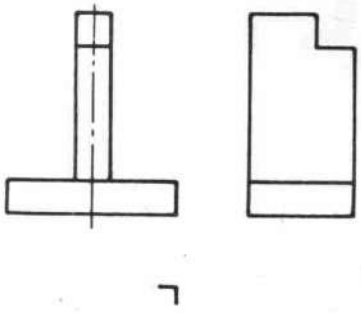
Draw the missing view.

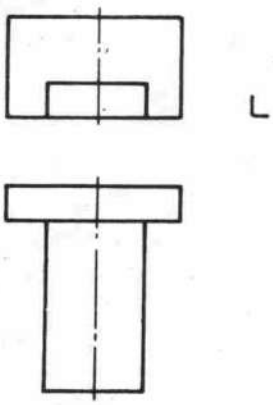












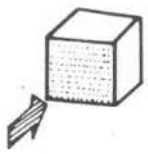
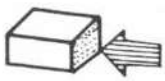
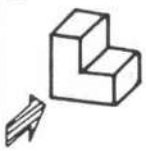
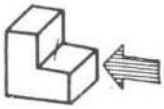
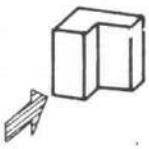
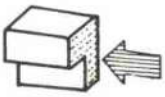
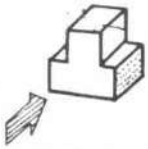
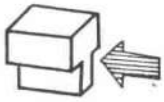
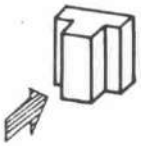
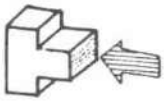
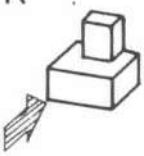
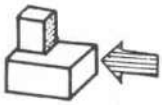
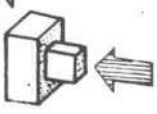
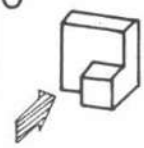
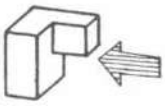
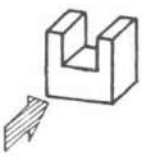
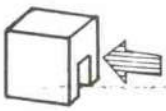
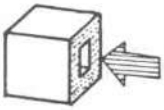
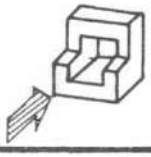
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Technical Drawing

No. 12

Find the correct views (1-21) belonging to the bodies (A-U)
Example: When you look at body "A" in the direction of the arrow you will see view "10"

BODY			VIEW				
A 	B 	C 	1	2	3	A	10
						B	
						C	
D 	E 	F 	4	5	6	D	
						E	
						F	
G 	H 	I 	7	8	9	G	
						H	
						I	
J 	K 	L 	10	11	12	J	
						K	
						L	
M	N 	O 	13	14	15	M	
						N	
						O	
P 	Q 	R 	16	17	18	P	
						Q	
						R	
S	T 	U 	19	20	21	S	
						T	
						U	

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

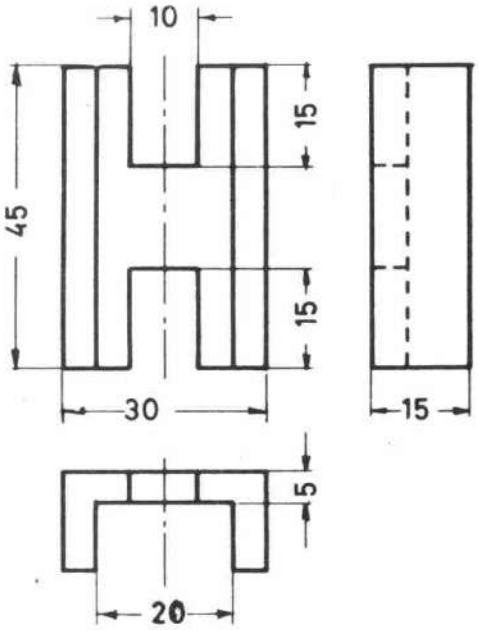
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Technical Drawing

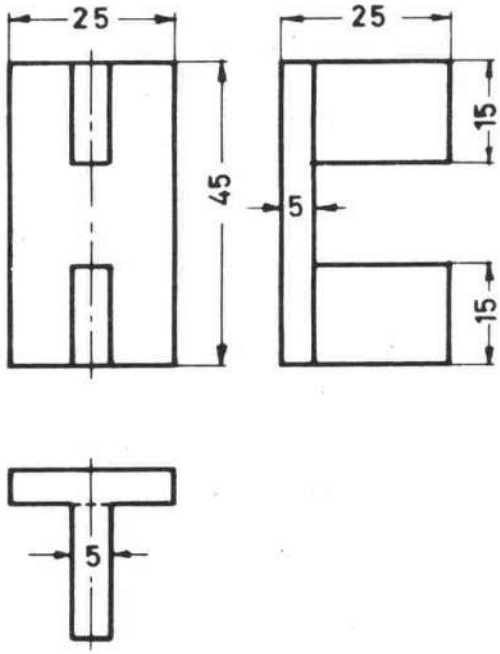
No. 13

Dimensioning

Example I

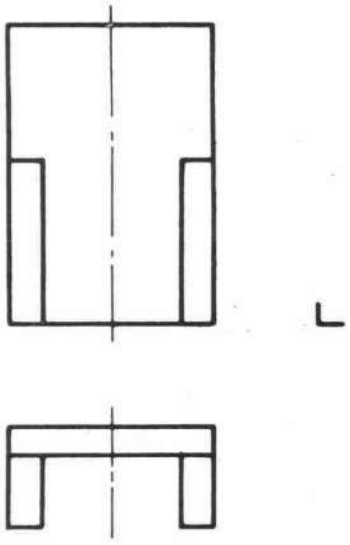


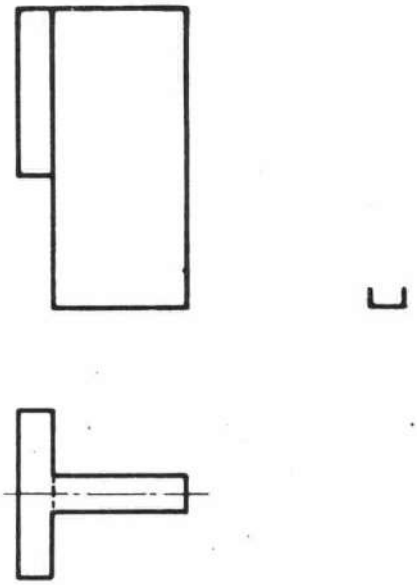
Example II



Note:-Give only as many dimensions as necessary.
-Avoid dimensioning at invisible (broken) lines.
-The centre line (dot-and-dash-line) is an important help for dimensioning symetrical work pieces.

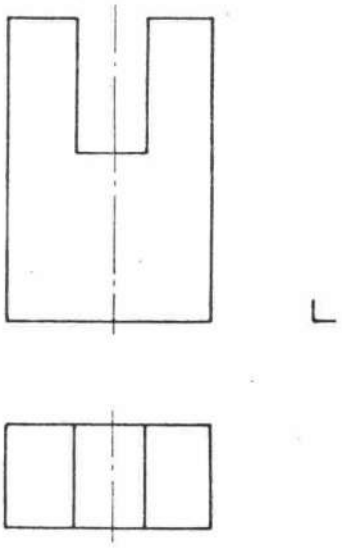
Exercise: Draw the side views and enter the dimensions.

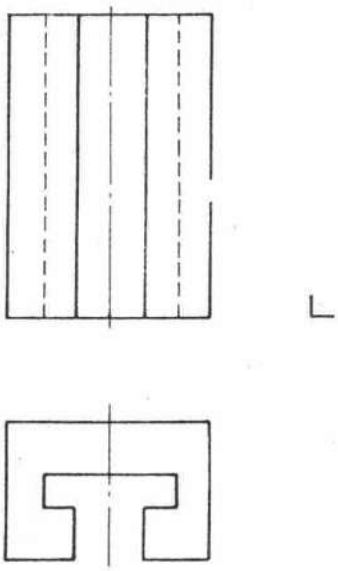


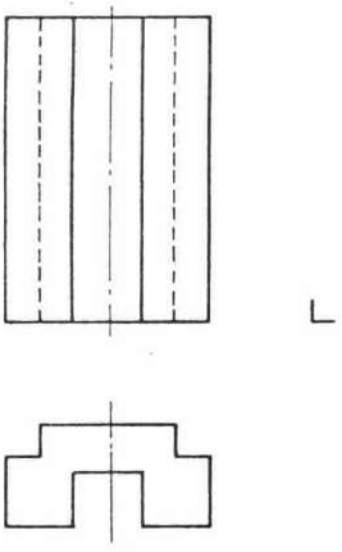


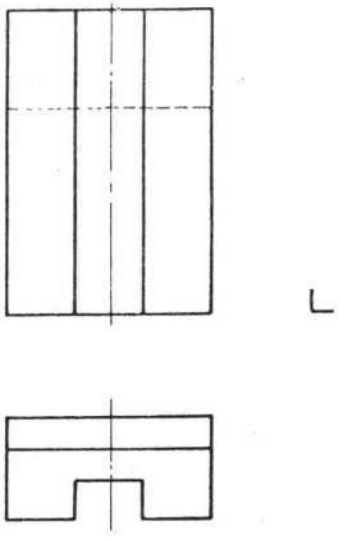
Draw the side views.

Enter the dimensions.









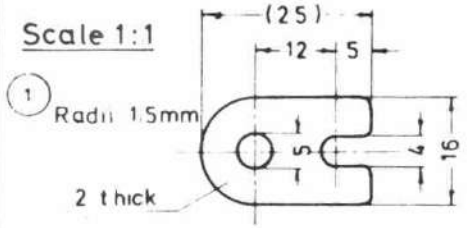
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Technical Drawing

No. 15

Scale 1:1

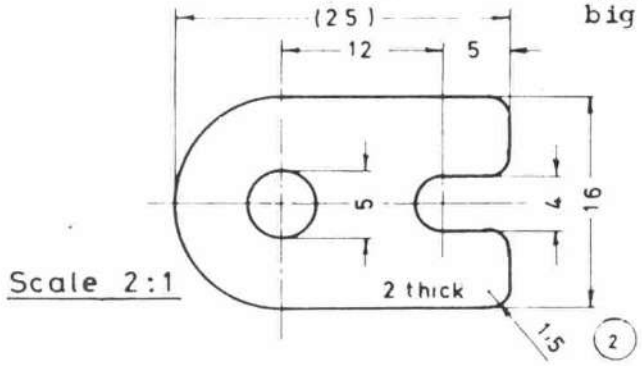


Drawing true to scale

Engineering drawings must always be prepared true to scale.

When the job to be drawn is too small an enlarged scale can be used.

When the job to be drawn is too big a reduced scale can be used.



Scale 2:1

Standard Scales

Full (plain): 1:1

Enlarged: 2:1, 5:1, 10:1

Reduced: 1:2.5, 1:5, 1:10

Note: - the dimensions given in the drawings - also in enlarged or reduced scale - always indicate the actual size.

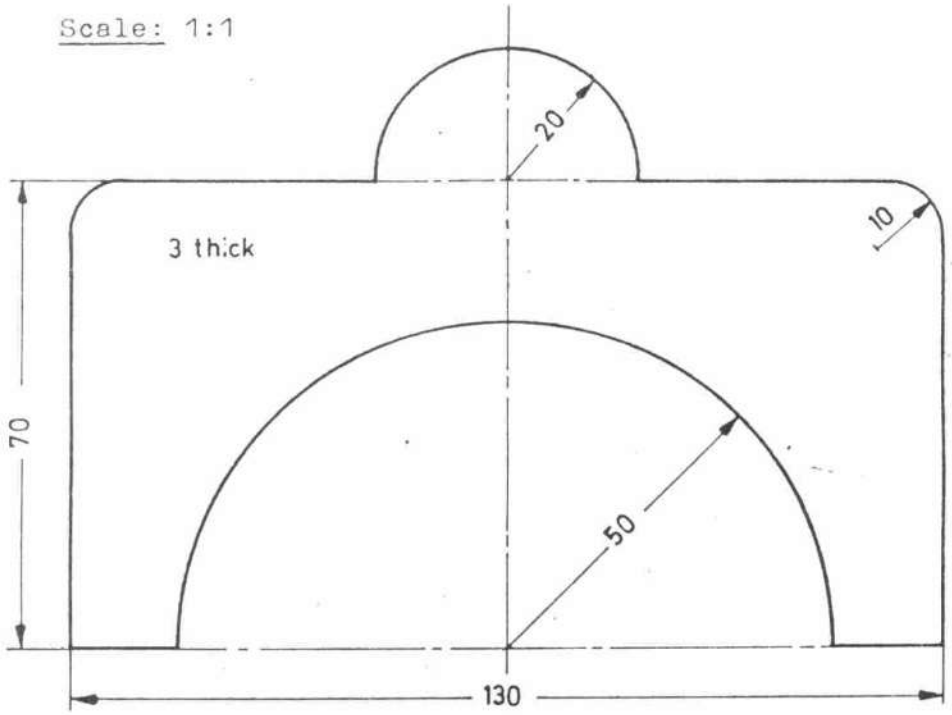
- the size "25" - helpful for cutting the raw length - is given in brackets, since otherwise the drawing would be over dimensioned.
- both ways of indicating the size of the radii (1) and (2) are correct.

Exercise:

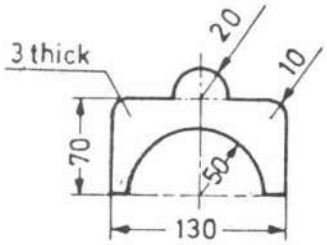
Draw the part in 5 times enlarged scale and enter all dimensions.

Scale 5:1

Scale: 1:1



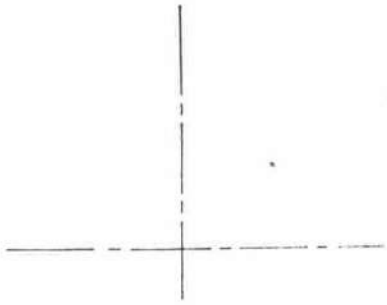
Scale: 1:5



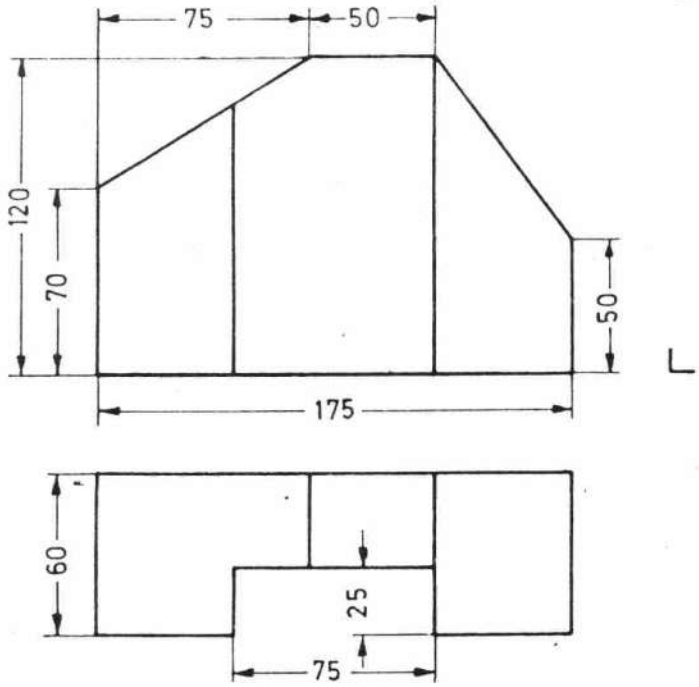
The selection of scale 1:5 proves to be too small for an engineering drawing in this case.

Scale: 1:2.5

Exercise: Draw the steel sheet true to scale.
Enter the dimensions.

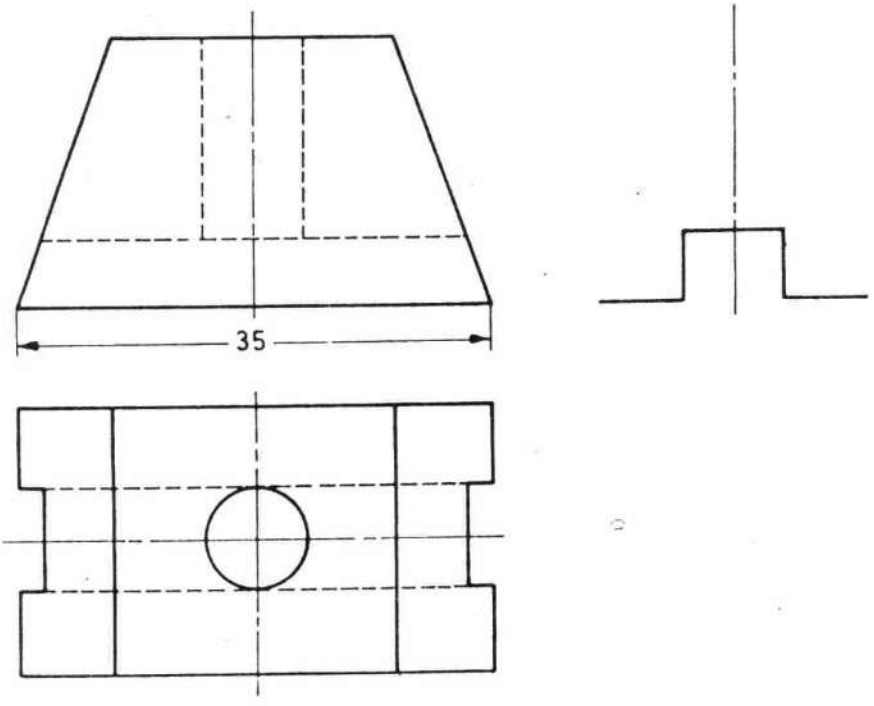


Draw the side view!



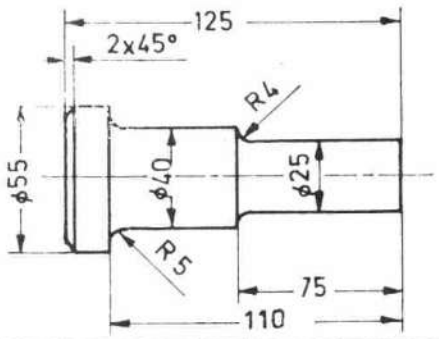
Scale: 1 : 2.5

Draw the side view. Enter the dimensions.



Scale: 2:1

Scale: 1:2.5



Cylindrical Workpieces

All necessary information can be taken here from the elevation alone.

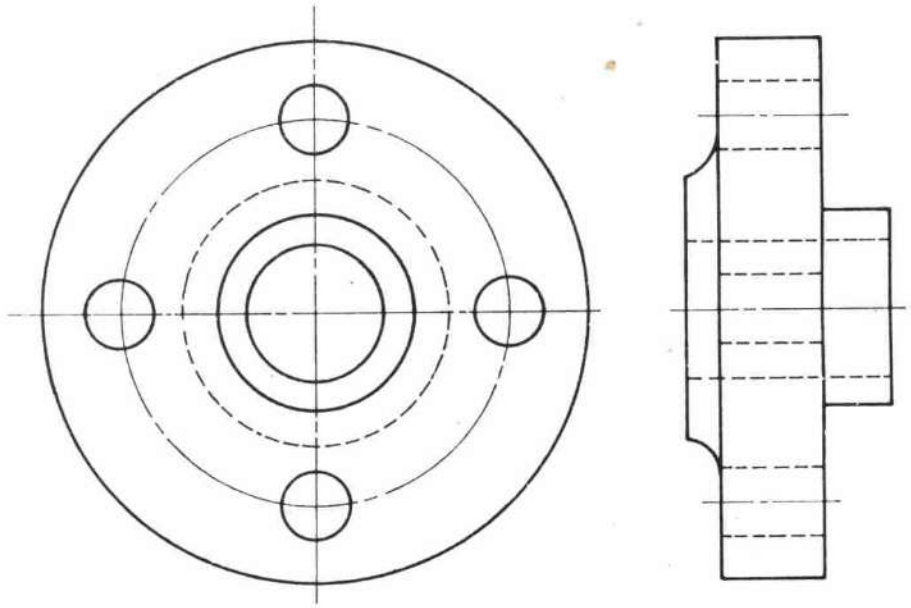
Only this view is therefore required.

Exercise: Draw the bolt in full scale with all dimensions.

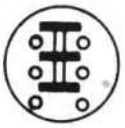
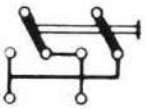
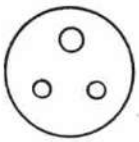
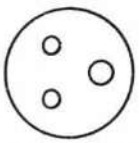
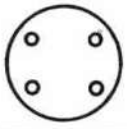
Scale: 1:1

To determine the shape of this flange one view would not be sufficient.

Exercise: Enter the dimensions!



Scale: 2:1

NAME	LAYOUT DIAGRAM	WIRING DIAGRAM TUMBLER SWITCH	WIRING DIAGRAM ROTARY SWITCH	CURRENTPATH DIAGRAM	BRITISH SYSTEM
SINGLE POLE SWITCH CUT-OUT SWITCH					
TWO POLE SWITCH					
THREE POLE SWITCH					
MULTICIRCUIT SWITCH					
CHANG-OVER SWITCH					
INTERMEDIATE SWITCH					
MOMENTARY CONTACT SWITCH (PUSH BUTTON)					
LAMP, general					
SOCKET EARTHING-CONTACT SAFETY SOCKET					
DISTRIBUTION BOX JUNCTION BOX					

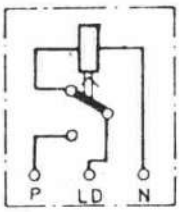
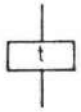
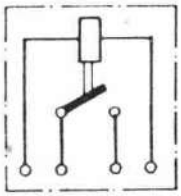
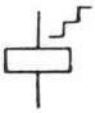
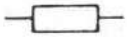
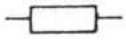
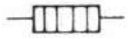
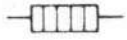
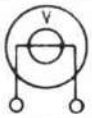
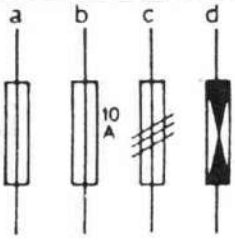
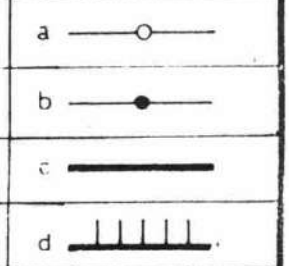
GRAPHICAL SYMBOLS
FOR DIFFERENT DIAGRAMS

TECHNICAL DRG.
No. 20

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL

NAME	LAYOUT DIAGRAM	WIRING DIAGRAM	CURRENTPATH DIAGRAM	BRITISH SYSTEM
TIME SWITCH D = Momentary contact switch P = Phase L = Lamp, half line				
IMPULSE SWITCH				
CHEMICAL CELL general				
MAINS, VOLTAGE STARTING POINT, general				
RESISTOR, general				
HEATER, general				
INDUCTIVE COIL general				
AMPERE-METER				
VOLT-METER				
FUSE a) general b) current mentioned c) number of fuses mentioned d) over voltage fuse		a) DETACHABLE CONNECTION b) NON-DETACHABLE CONNECTION c) CONDUCTIVE CONNECTION d) DISTRIBUTION		

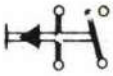
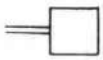
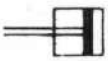
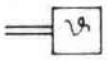
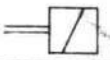
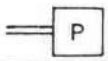
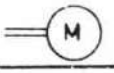
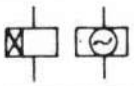
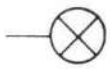
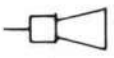
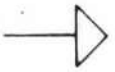
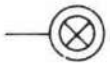
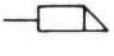
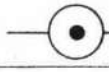
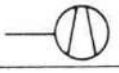
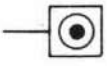
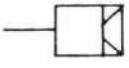
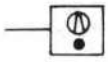
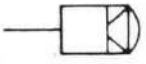
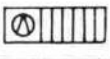
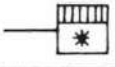
GRAPHICAL SYMBOLS
FOR DIFFERENT DIAGRAMS

TECHNICAL DRG.
No. 21

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL

CONTACTS : CLOSER, OPENER, CHANGER	MOMENTARY CONTACT CLOSER	MOMENTARY CONTACT WITH OPENER AND CLOSER 
HAND DRIVE SWITCH	MOMENTARY CONTACT OPENER	END SWITCH OPENER CAM DRIVE
NON CONDUCTIVE	FOOT OPERATED	ABRUPT MOVE IN DIRECTION OF ARROW
HANDLE, HAND OPERATED	CAM DRIVE	TIME-LAG IN DIRECTION OF ARROW
POWER DRIVE, GENERAL 	AIR PRESSURE DRIVE 	THERMIC DRIVE 
MAGNETIC DRIVE 	PRESSURE DRIVE 	MOTOR DRIVE 
CONTACTOR, RELAY, GENERAL	ELETROMAGNETIC OVERCURRENT RELAY	ELECTROTHERMIC OVERCURRENT RELAY
CONTACTOR WITH TWO WINDINGS	UNDER-VOLTAGE RELEASE	TIME RELAY 
LIGHT-INDICATOR, GENERAL 	BELL	HORN 
POINTER-INDICATOR NUMBER- " DIRECTION- "	BELL WITH INDICATOR	SIREN 
MOMENTARY CONTACT-SWITCH WITH LIGHT INDICATOR 	BUZZER	DOOR OPENER MAGNETIC LOCK 
ELECTRICAL APPLIANCE GENERAL	WATER-HEATER 	FAN 
COOKING RANGE	WASHING MACHINE 	RADIO 
REFRIGERATOR * -12° C ** -18° C	WASH-DRYER 	TELEVISION 
FREEZER BELOW -18° C	HEATER WITH EXOTHERMIC CONTROL 	AIR CONDITIONER 

GRAPHICAL SYMBOLS
FOR DIFFERENT DIAGRAMS

TECHNICAL DRG. No. 22

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

Wiring general	Protective wire e.g. ground neutral	Wire with indicated number of conductor (4)
Insulated dry-room wiring (t)	Insulated dampproof wiring (f)	Insulated wire in conduit
Cable wiring (k)	Wiring, exposed	Wiring, concealed e.g. in plaster
Underground cable	Overhead line	Feed point with directional indicated input
Lamp general	Lamp with 2 separate circuits	Discharge lamp, general
Fluorescent lamp	Choke	Starter
Grounding with specification of purpose	Ground connecting point	Housing
House-connection box	Transformer rectifier (interphone etc.)	Transformer 220/6V

	GERMAN	ENGLISH	U.S.
DIRECT CURRENT			
Armature winding	A - B	AA - A	A_1 - A
Shunt field winding	C - D	Z - ZZ	F^1 - F^2
Series field winding	E - F	Y - YY	S^1_1 - S^2_2
Interpole winding	G - H	HH - H	
Compensation winding		KK - K	
Separate winding	I - K	X - XX	
Separate excit. wdg.	U - V - W	D - E - F	M_1 - M_2 - M_3
Slip-ring winding			
ALTERNATING CURRENT 3~			
Stator	U - X V - Y W - Z	A_1 - A_2 B_1 - B_2 C_1 - C_2	T_1 - T_4 T_2 - T_5 T_3 - T_6
Multi speed stator			
Low speed	U_a - V_a - W_a	A_3 - B_3 - C_3	T_1 - T_2 - T_3
High speed	U_b - V_b - W_b	A_2 - B_2 - C_2	T_4 - T_5 - T_6
Rotor 3 phase	u - v - w	D - E - F	M_1 - M_2 - M_3
Rotor 2 phase	u - xy - v	D - DE - E	M_1 - M_2 - M_3
ALTERNATING CURRENT 1~			
Main winding	U - V	A_1 - A_2	T_1 - T_4
Starter winding	W - Z	Z_1 - Z_2	T_5 - T_8
TRANSFORMERS			
Mains	L1 - L2 - L3	L1 - L2 - L3	
Neutral	N	N	
Protective wire	PE	E	

GRAPHICAL SYMBOLS & LIST OF CODES

TECHNICAL DRG. No. 23

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

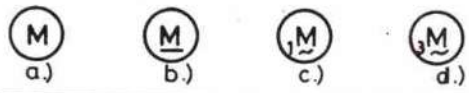
ELECTRICIAN GENERAL

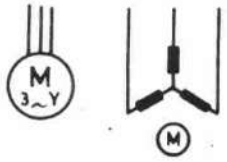
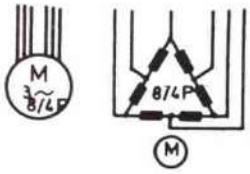
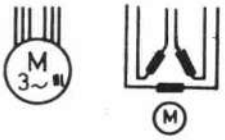
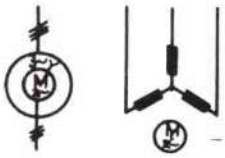
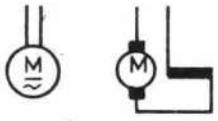
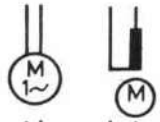
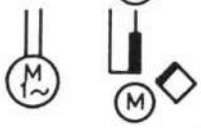
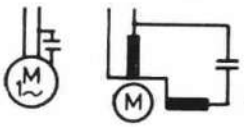
GENERATOR

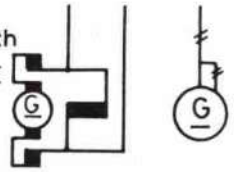
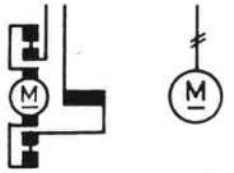
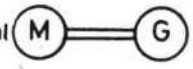
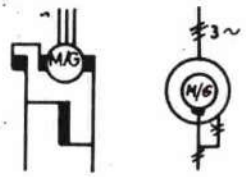
a) general, b).... d) current mentioned

MOTOR

a) general, b)..... d) current mentioned



SYMBOLS	NAME
	SQUIRREL CAGE MOTOR Y-CONNECTED
	SQUIRREL CAGE MOTOR TWO SPEEDS
	SQUIRREL CAGE MOTOR OPEN ENDS
	SLIP - RING MOTOR
	UNIVERSAL MOTOR
	CRANK START MOTOR
	SPLIT POLE MOTOR
	CAPACITOR MOTOR

NAME	SYMBOL
GENERATOR SEPARATELY EXCITED	
SHUNT - GENERATOR	
SHUNT - GENERATOR with symmetrical INTERPOLE WINDING	
SERIES - MOTOR	
COMPOUND - MOTOR	
SERIES - MOTOR with symmetrical INTERPOLE and COMPENSATING WINDING	
MOTOR-GENERATOR, general	
ROTARY CONVERTER	

SYMBOLS FOR SOME EL. MACHINES

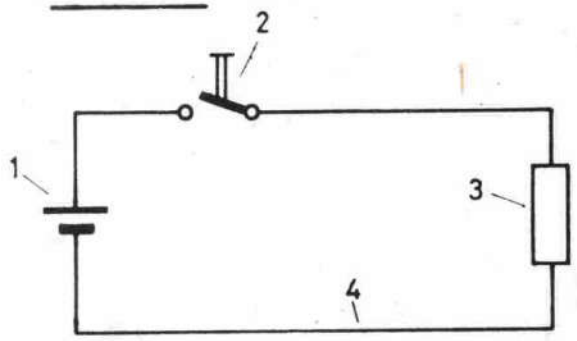
TECHNICAL DRG. No. 24

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

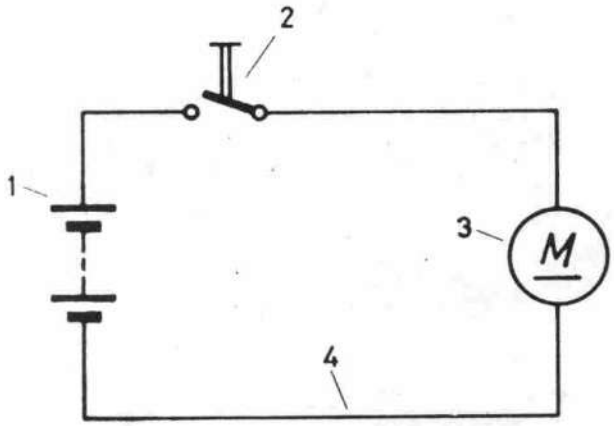
ELECTRICIAN GENERAL

CIRCUIT

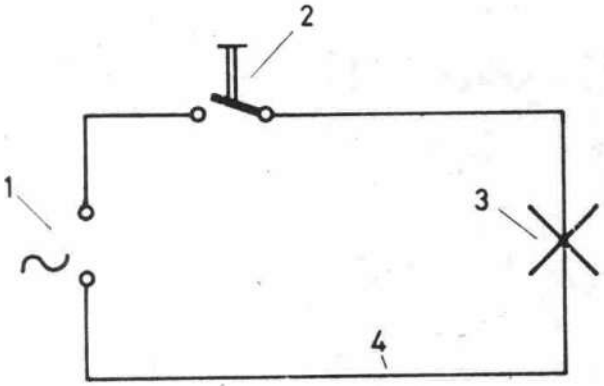


DESCRIBE THE COMPONENTS OF THE CIRCUITS

1. ----------
2. ----------
3. ----------
4. ----------



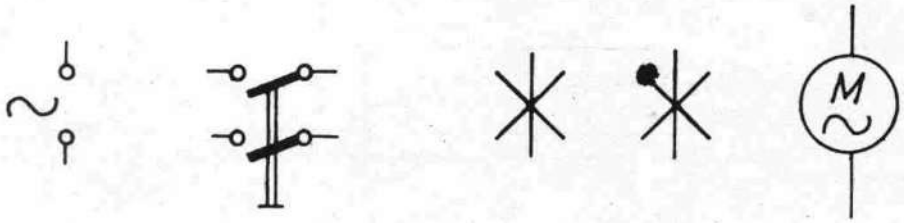
1. ----------
2. ----------
3. ----------
4. ----------

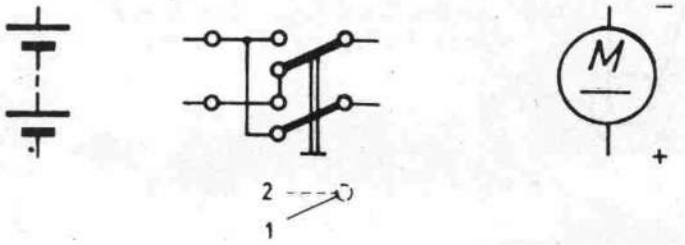


1. ----------
2. ----------
3. ----------
4. ----------

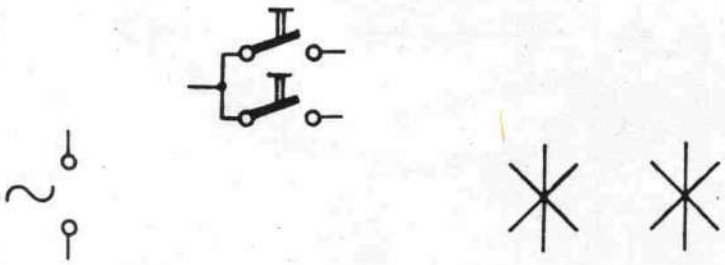
	SIMPLE CURRENT PATH DIAGRAMS	TECHNICAL DRG. No. 25
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE CIRCUITS





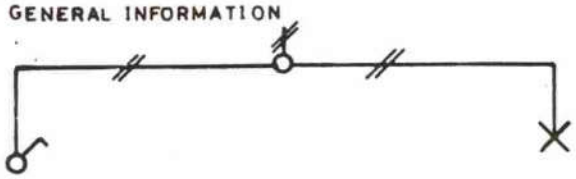
ALSO INDICATE THE POLARITY OF VOLTAGE ON THE MOTOR ACCORDING TO SWITCH POSITION



	SIMPLE CURRENT PATH DIAGRAMS	TECHNICAL DRG. No. 26
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

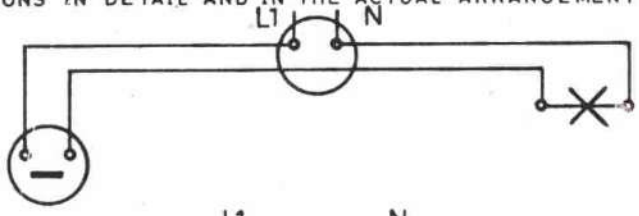
INSTALLATION LAYOUT DIAGRAM

SIMPLIFIED REPRESENTATION GIVES GENERAL INFORMATION



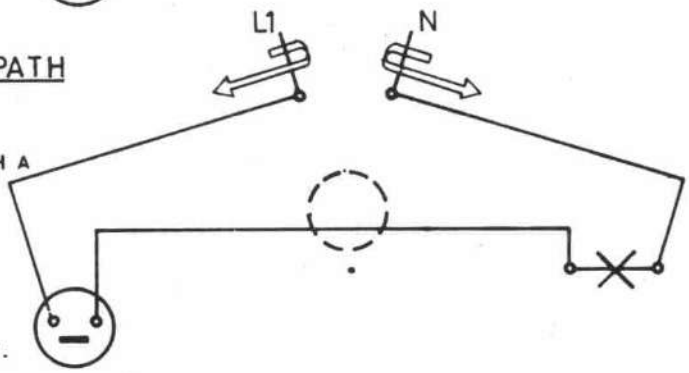
WIRING DIAGRAM

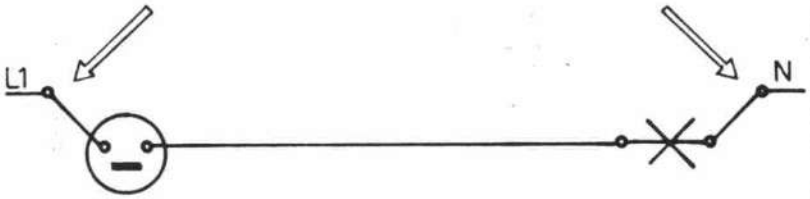
SHOWS ALL WIRES AND CONNECTIONS IN DETAIL AND IN THE ACTUAL ARRANGEMENT



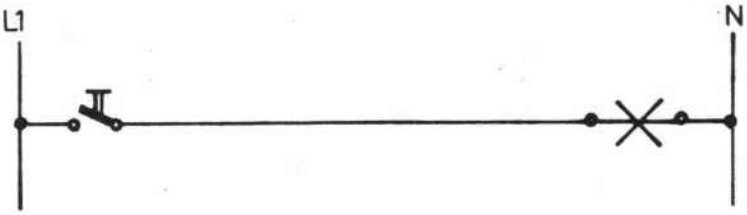
CONVERSION of WIRING - DIAGRAM into CURRENT - PATH DIAGRAM

STRETCH THE SUPPLY LINES OF THE WIRING DIAGRAM IN SUCH A WAY THAT YOU HAVE THE PHASE ON ONE SIDE AND THE NEUTRAL ON THE OTHER SIDE WITH ALL INSTALLATION COMPONENTS IN BETWEEN. IN THIS WAY YOU CAN EASILY FOLLOW THE PATH OF CURRENT.





CURRENT PATH DIAGRAM



TYPES OF DIAGRAMS

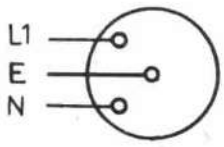
TECHNICAL DRG. No. 27

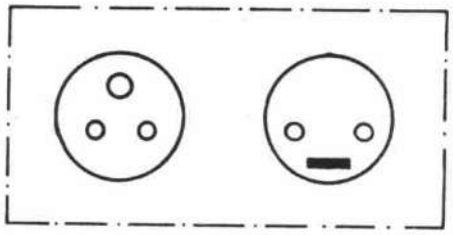
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

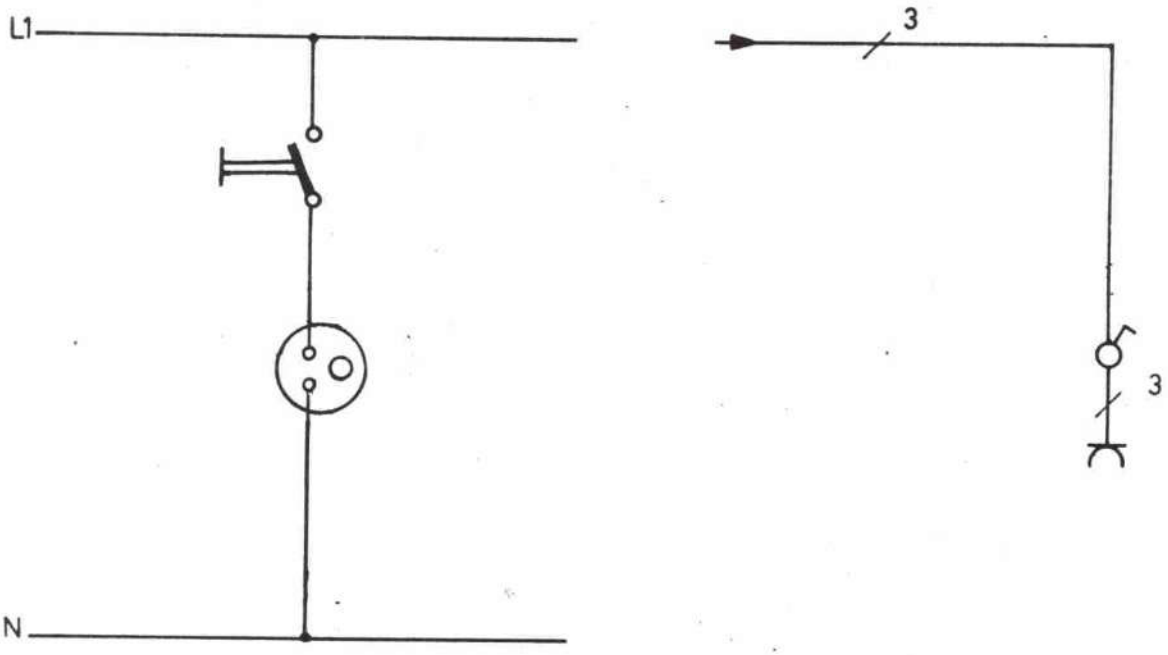
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

COMPLETE THE WIRING DIAGRAM.







SINGLE POLE SWITCH CIRCUIT

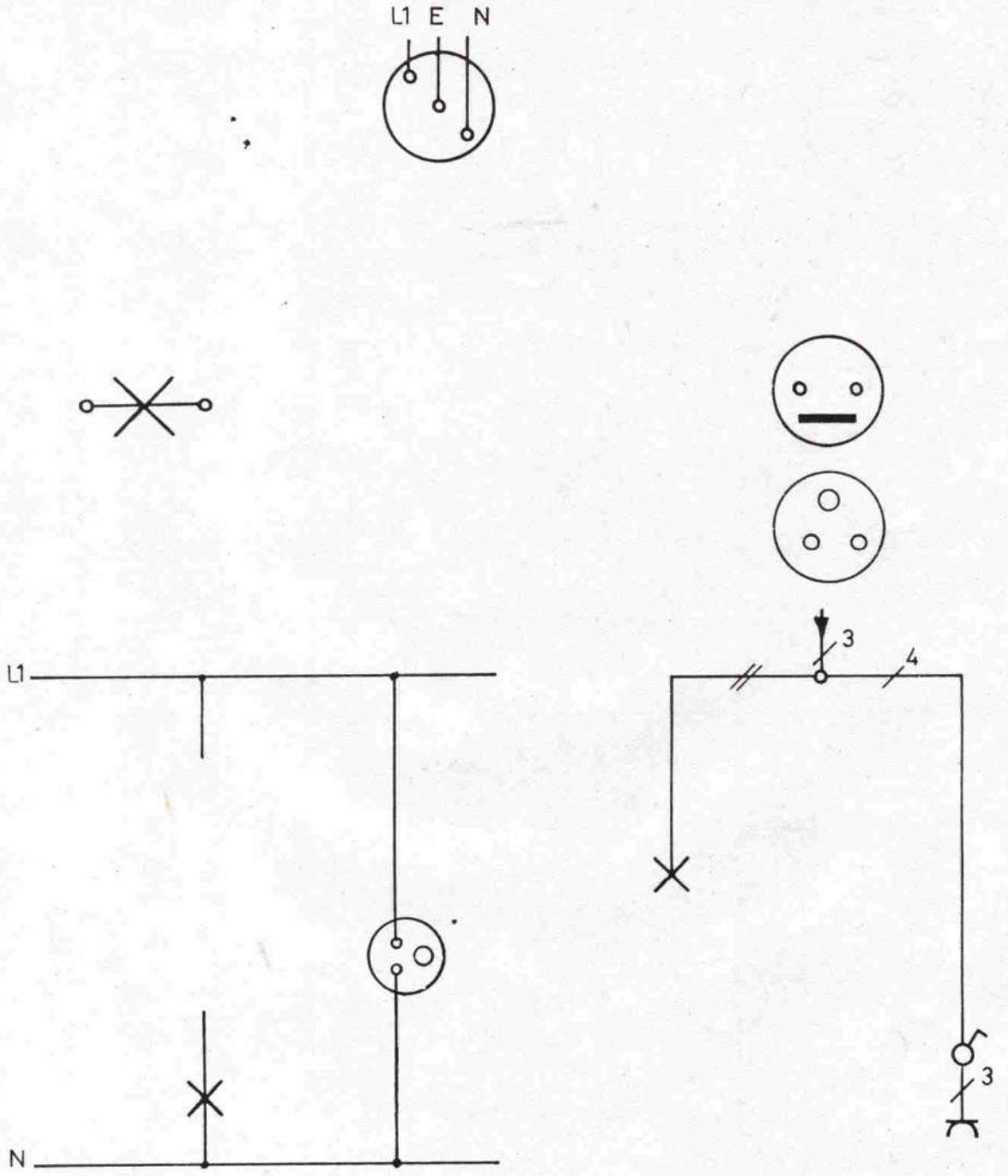
TECHNICAL DRG. No. 28

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

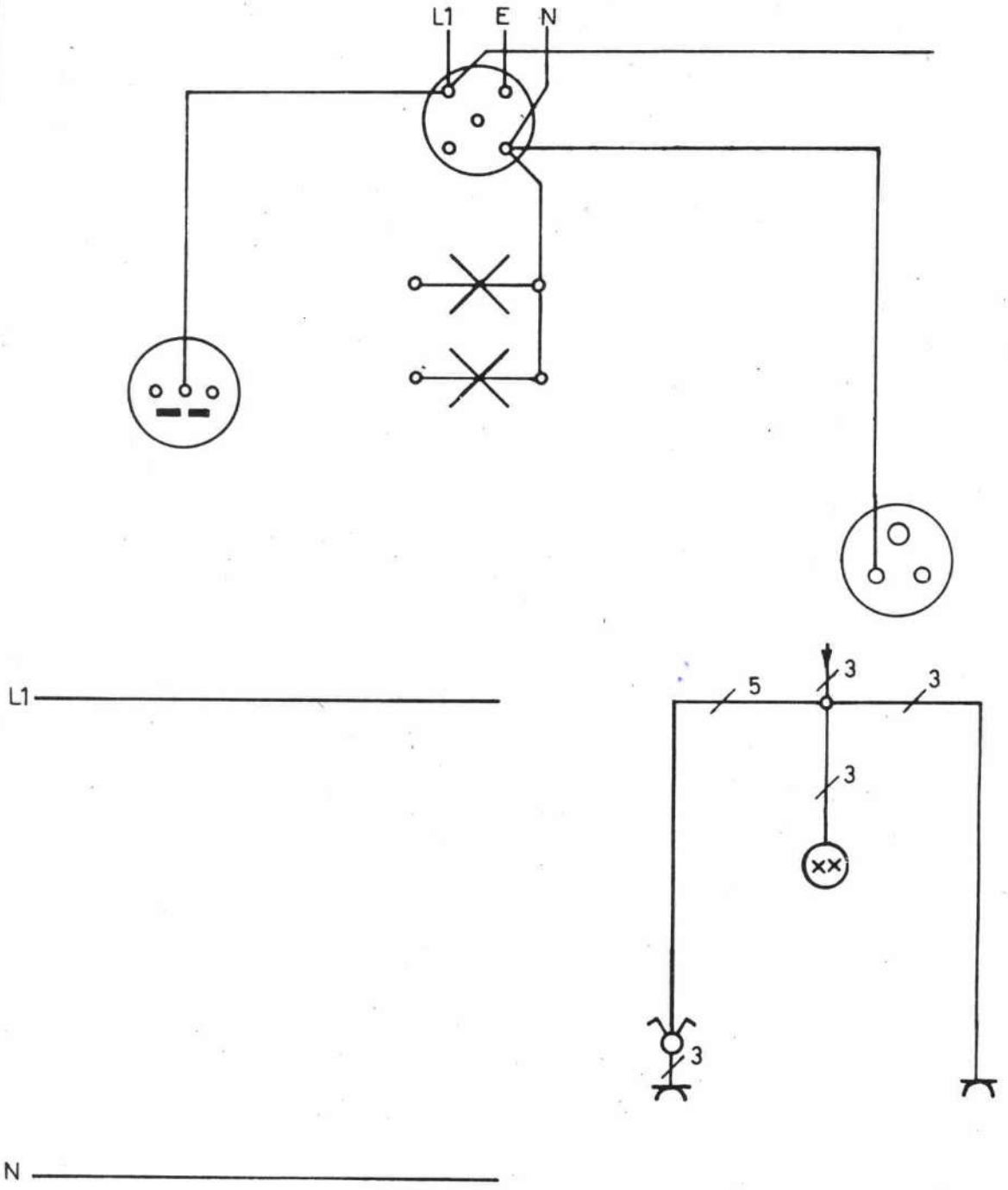
ELECTRICIAN GENERAL

COMPLETE THE WIRING AND CURRENT PATH DIAGRAM.



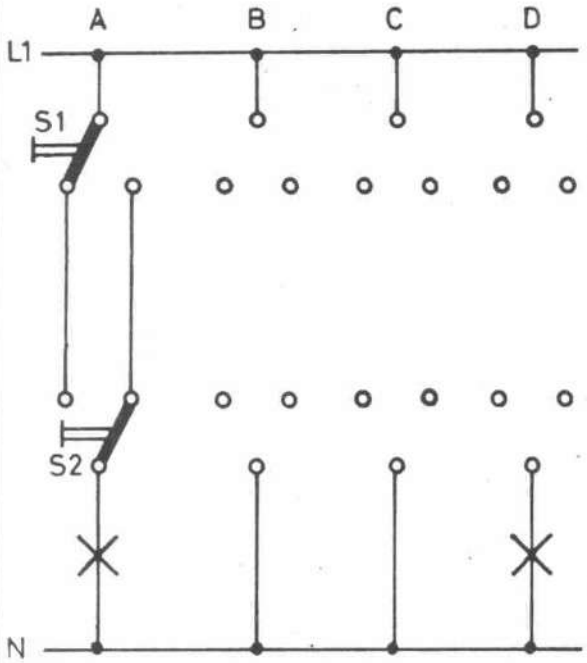
	SINGLE POLE SWITCH CIRCUIT	TECHNICAL DRG. No. 29
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING AND CURRENT PATH DIAGRAM.



	MULTICIRCUIT SWITCH CIRCUIT	TECHNICAL DRG. No. 30
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING AND CURRENT PATH DIAGRAM.



Complete the Current path diagram so that the following conditions are fulfilled:

Circuit A: Lamp switched off by S1 & S2
Circuit B: Lamp switched on by S1
Circuit C: Lamp switched off by S2
Circuit D: Lamp switched on by S1

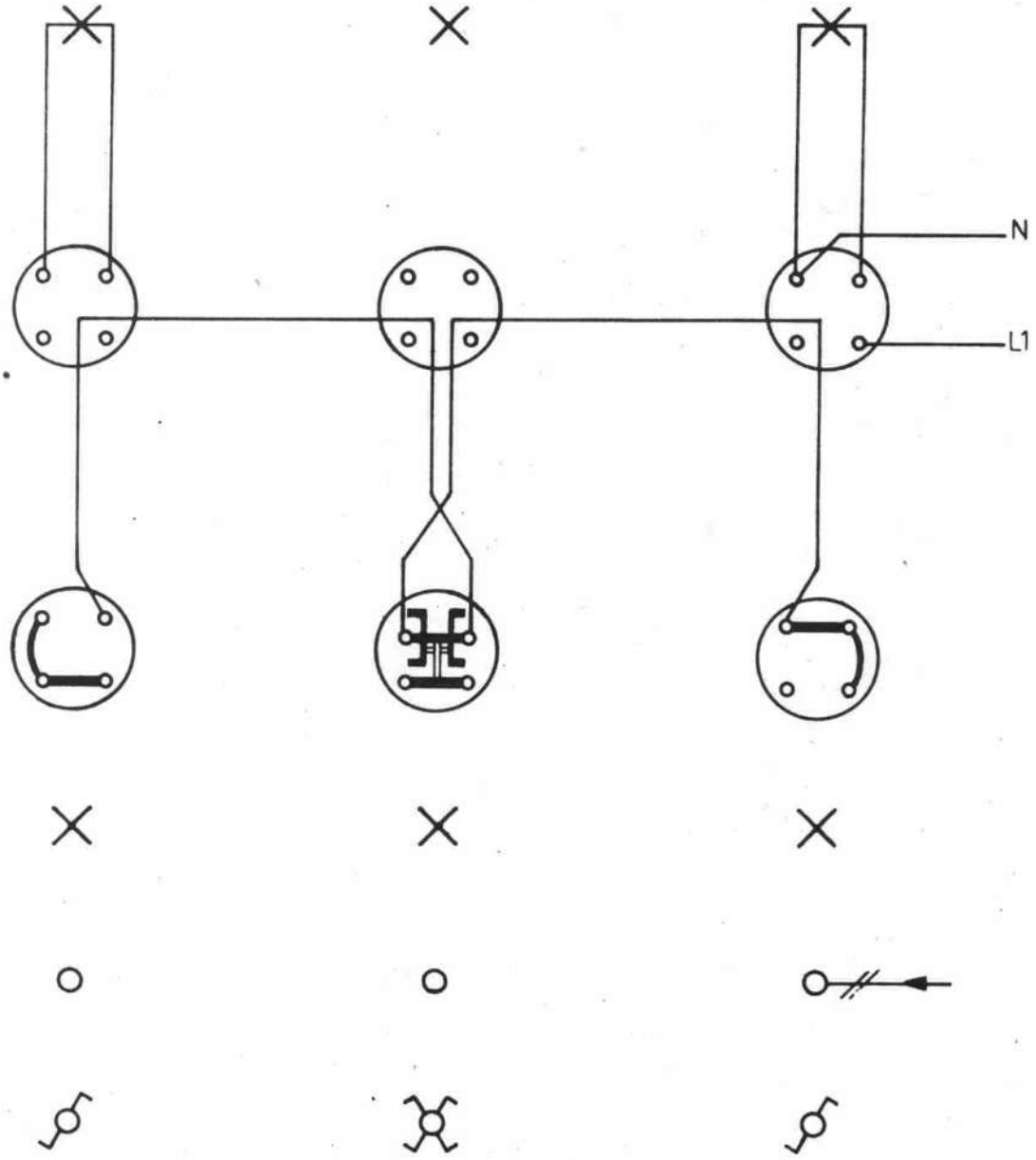
	TWO - WAY SWITCH CIRCUIT	TECHNICAL DRG. No. 31

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

COMPLETE THE WIRING AND LAYOUT DIAGRAM



	INTERMEDIATE SWITCH CIRCUIT	TECHNICAL DRG. No. 32

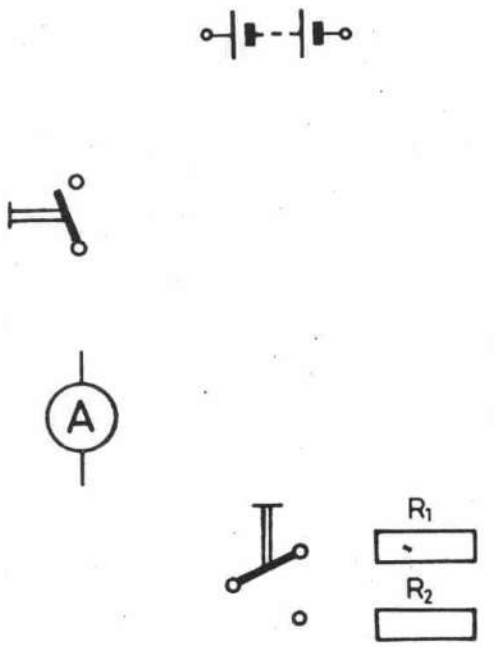
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

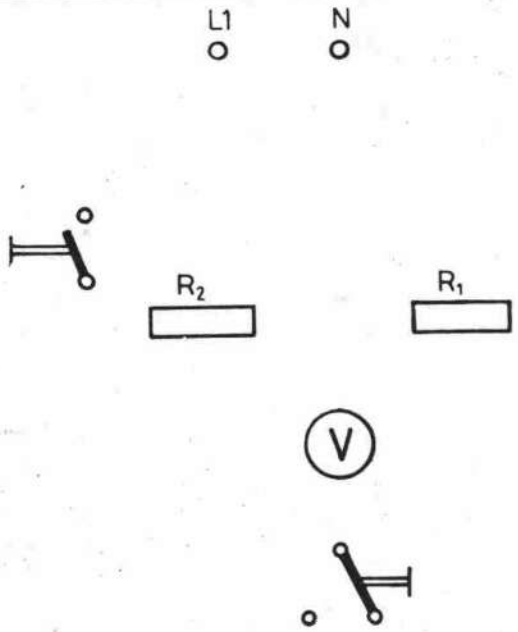
ELECTRICIAN GENERAL

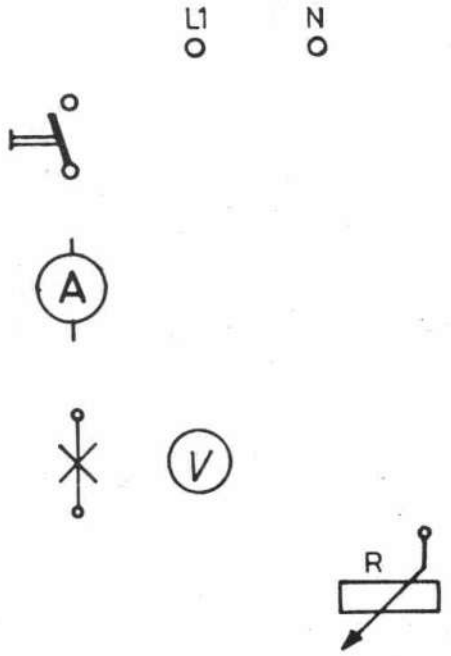
COMPLETE THE CIRCUITS

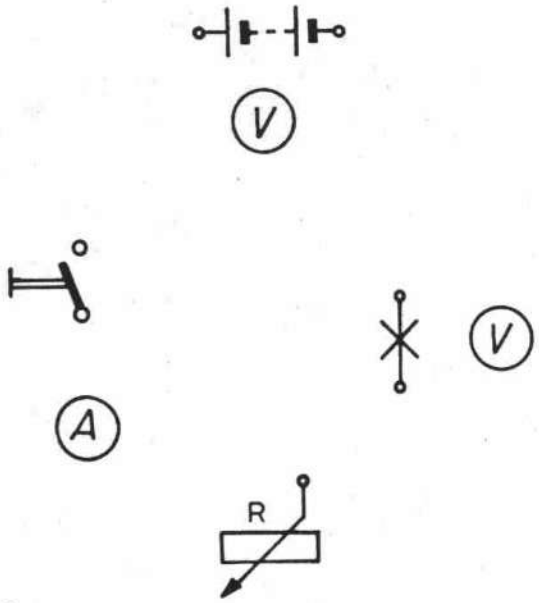
To measure I_1 and I_2



To measure V_1 and V_2







VOLT & AMMETER CONNECTIONS

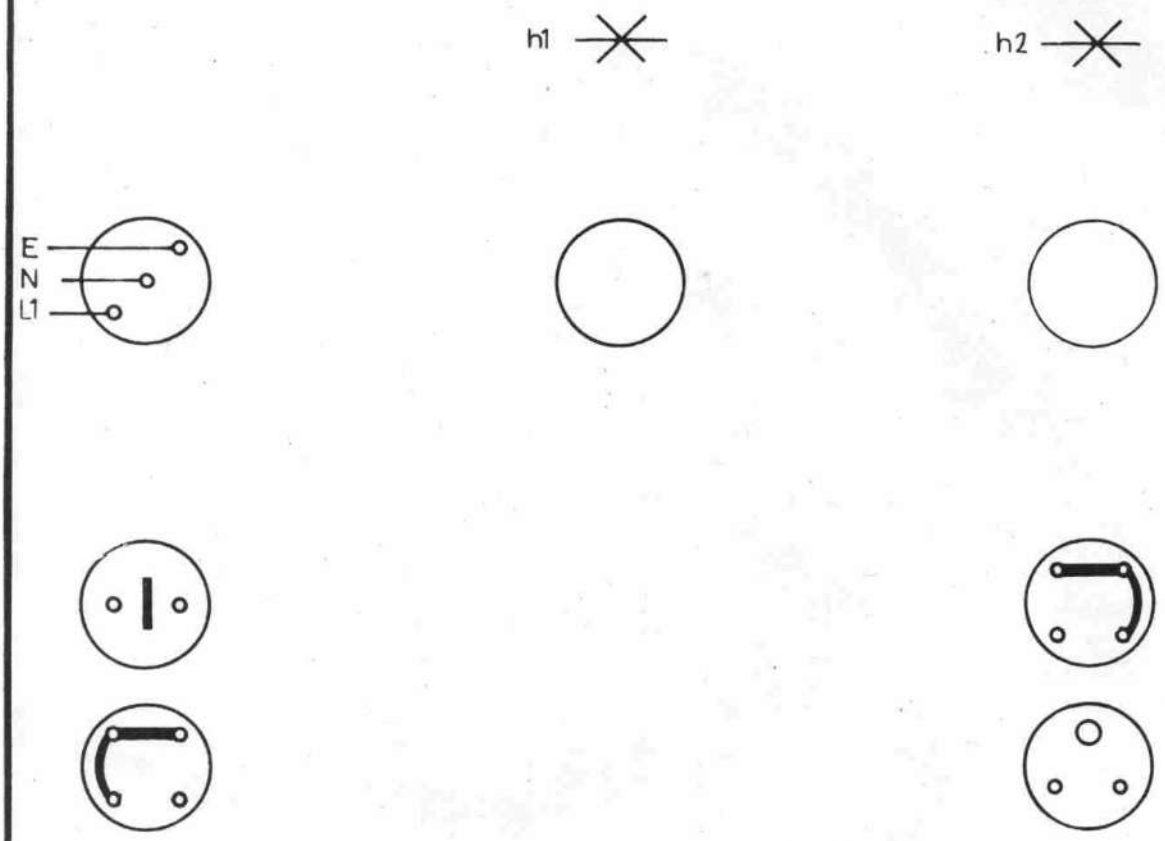
TECHNICAL DRG. No. 33

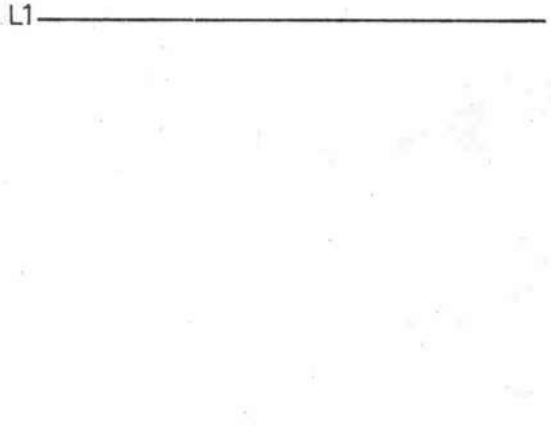
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

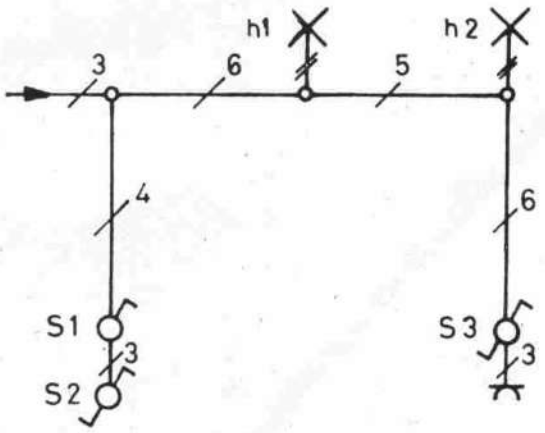
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

COMPLETE THE WIRING AND CURRENT PATH DIAGRAM





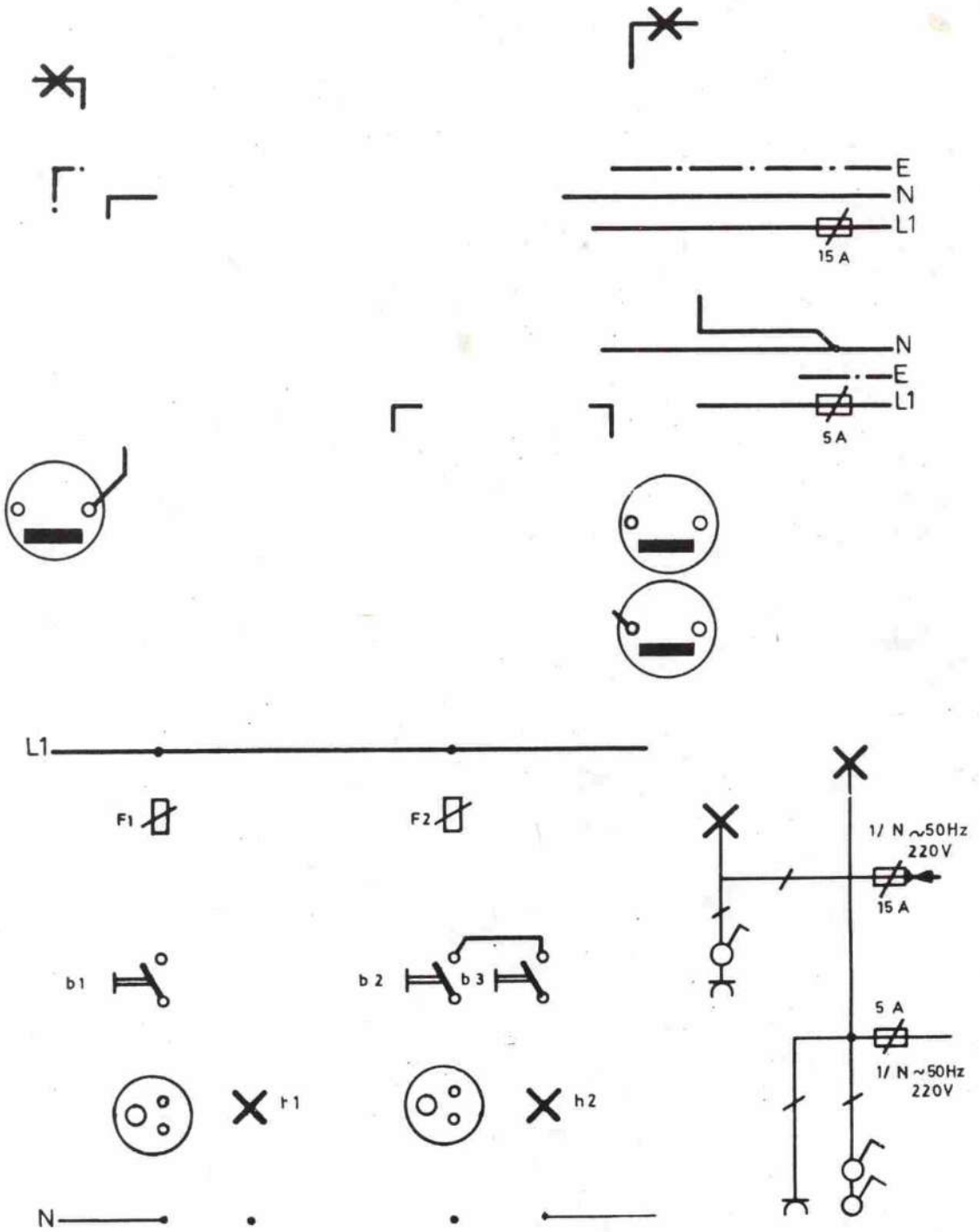


Lamp h1 is controlled by switch S1

Lamp h2 is controlled by switches S2 & S3

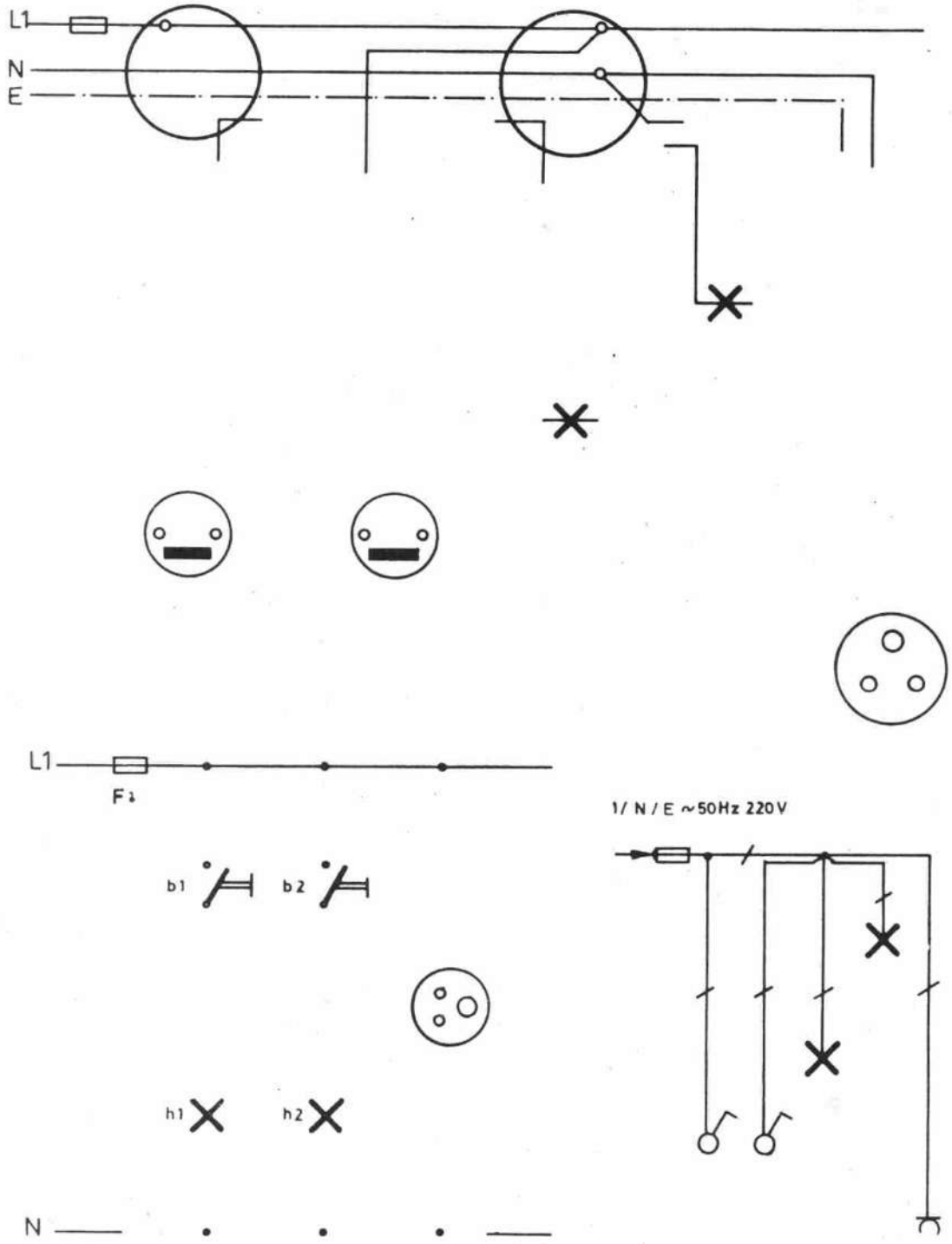
	CIRCUIT WITH SINGLE POLE-CHANGE-OVER SWITCH AND SOCKET	TECHNICAL DRG. No. 34
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING, CURRENT PATH AND INSTALLATION LAYOUT DIAGRAM



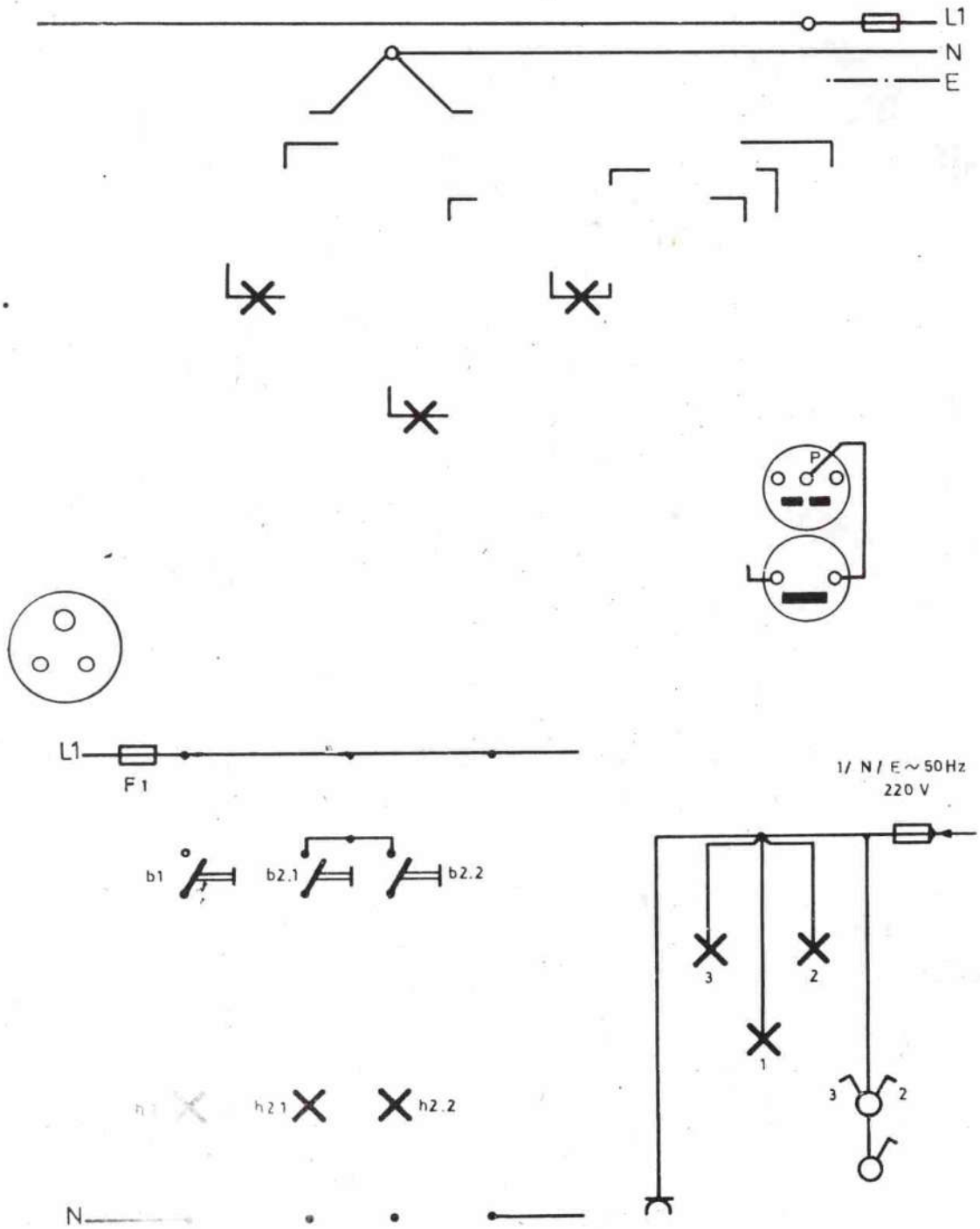
	COMBINATION OF TWO CIRCUITS	TECHNICAL DRG. No. 35
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING, CURRENT PATH AND INSTALLATION LAYOUT DIAGRAM



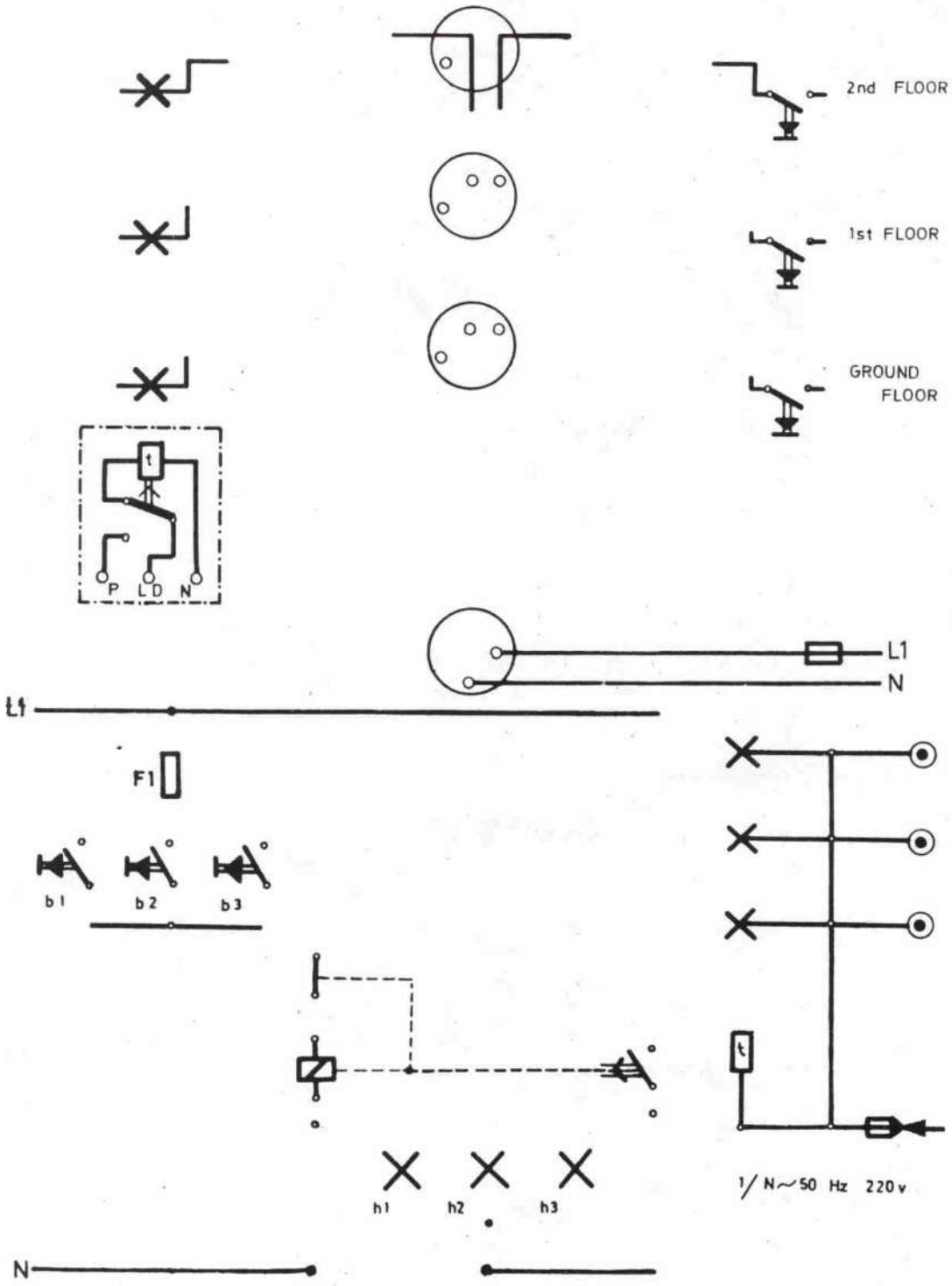
	KITCHEN INSTALLATION	TECHNICAL DRG. No. 36
	DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME	ELECTRICIAN GENERAL

COMPLETE THE WIRING, CURRENT PATH AND INSTALLATION LAYOUT DIAGRAM



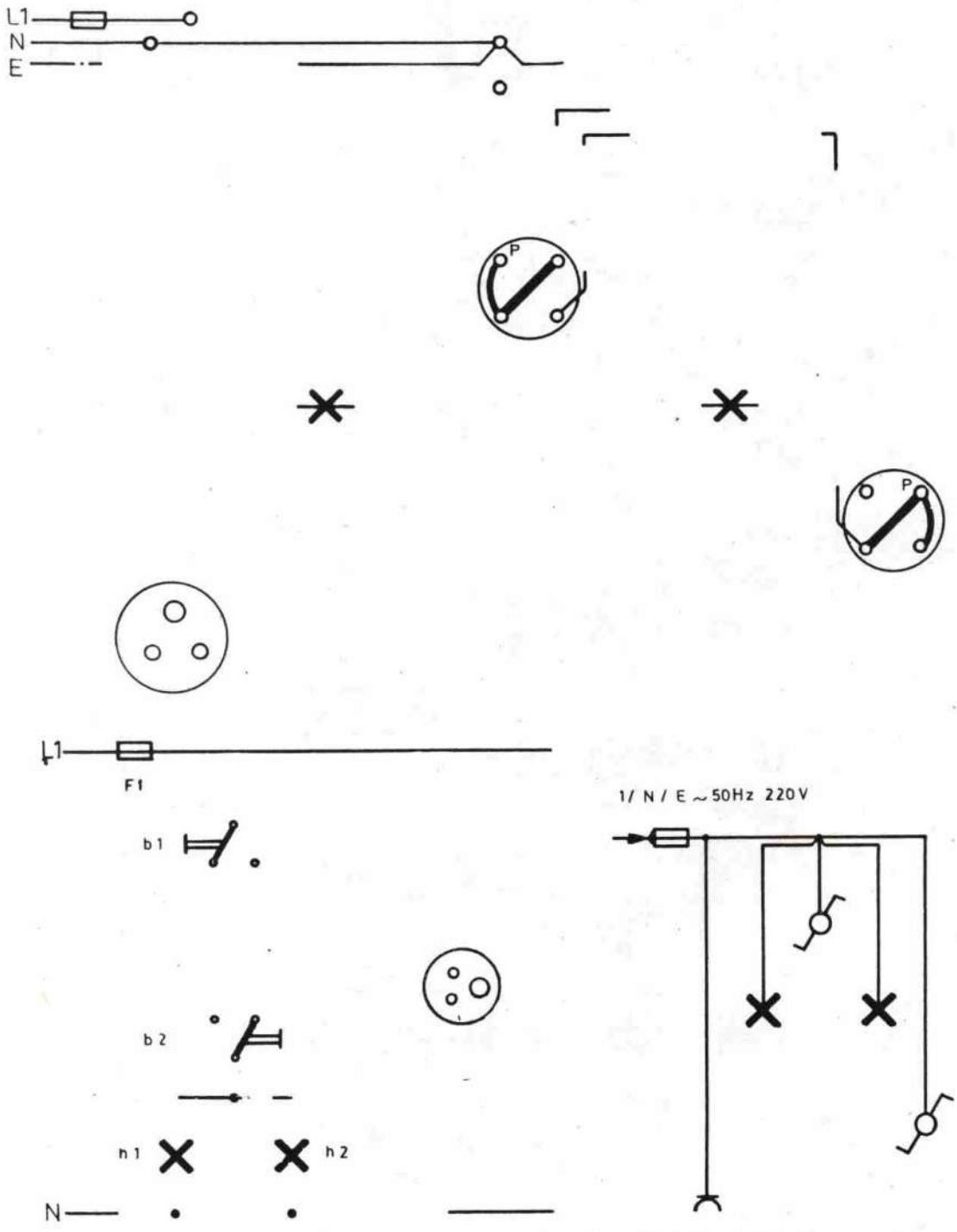
	LIVING ROOM INSTALLATION	TECHNICAL DRG. No. 37
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING, CURRENT PATH AND INSTALLATION LAYOUT DIAGRAM



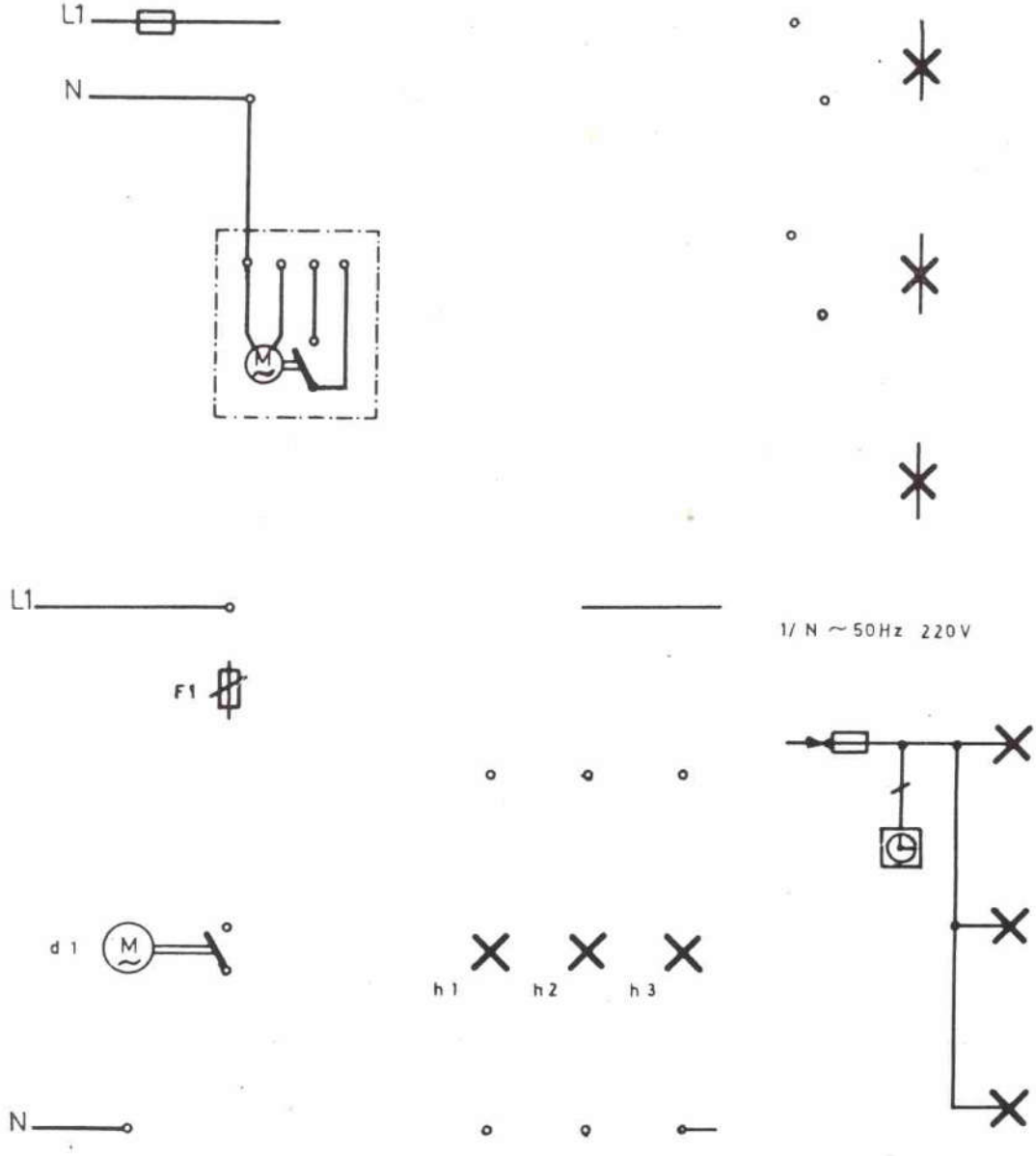
	STAIR CASE INSTALLATION	TECHNICAL DRG. No. 38
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING, CURRENT PATH AND INSTALLATION LAYOUT DIAGRAM



	SLEEPING ROOM INSTALLATION	TECHNICAL DRG. No. 39
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE WIRING,CURRENT PATH AND INSTALLATION LAYOUT DIAGRAM.



TIME SWITCH INSTALLATION

TECHNICAL DRG. No. 40

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

COMPLETE THE INSTALLATION LAYOUT DIAGRAM

1 CIRCUIT 15A. FOR ROOM 1
LAMP 1 CONTROLLED BY S.P.S. 1
LAMPS 2+3 CONTROLLED BY S.P.S. 2+3

1 CIRCUIT 10 A. FOR ROOM 2
1 LAMP CONTROLLED BY 1 S.P.S.

1 CIRCUIT 5A. FOR THE VERANDA
1 LAMP CONTROLLED BY 1 S.P.S.

ALL SOCKETS DIRECTLY CONNECTED, THAT IS WITHOUT SWITCH

COMPLETE THE INSTALLATION-LAYOUT OF VERANDA AND ROOM NO. 1
INDICATE NUMBER OF WIRES AND SIZE OF WIRES. THE LAYOUT OF ROOM NO. 2 IS ALREADY COMPLETE
AND MAY SERVE AS A SAMPLE. (AMBIENT TEMPERATURE = 45°C = 113°F)
GIVE ALSO THE INSIDE MEASUREMENTS OF THE ROOMS.

SCALE 1 : 50	INSTALLATION LAYOUT DIAGRAM	TECHNICAL DRG. No. 41

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

COMPLETE THE INSTALLATION LAYOUT DIAGRAM.

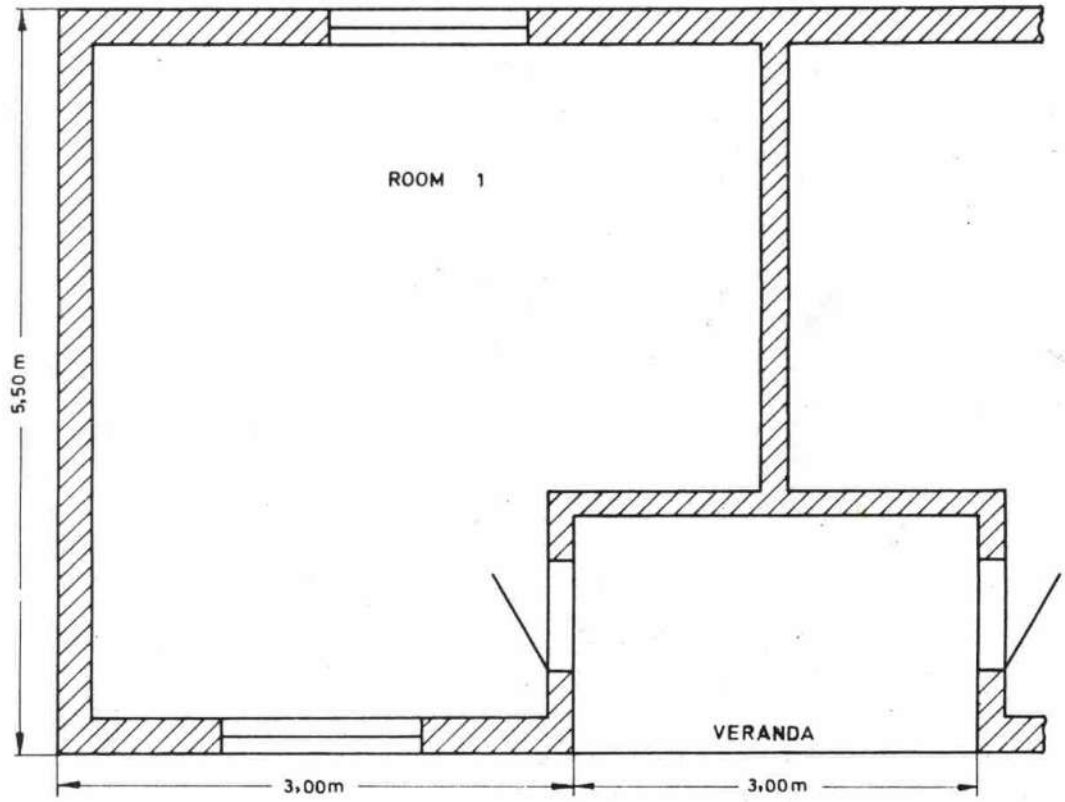
A. DRAW THE FOLLOWING SYMBOLS FOR INSTALLATION LAYOUTS:

LAMP.....	MOMENTARY CONTACT SWITCH....
SOCKET, (3 PIN SAFETY).....	TREMBLER BELL .....
SINGLE POLE SWITCH.....	FUSE.....
CHANGE-OVER SWITCH	ENERGY METER .....

B. THE FOLLOWING ITEMS ARE TO BE FITTED IN THE ROOM SHOWN BELOW:

1 POWER SOCKET 15A. (SEPARATE CIRCUIT)
1 LAMP IN THE CENTRE OF THE ROOM
1 SINGLE POLE SWITCH

CONSIDER THE MOST FAVOURABLE ARRANGEMENT OF ALL COMPONENTS AND DRAW THE INSTALLATION LAYOUT. FUSE AND ENERGY METER ARE LOCATED AT THE VERANDA.



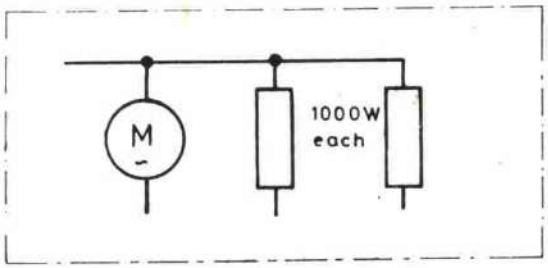
	INSTALLATION LAYOUT DIAGRAM	TECHNICAL DRG. No. 42
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

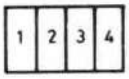
COMPLETE THE WIRING DIAGRAM.

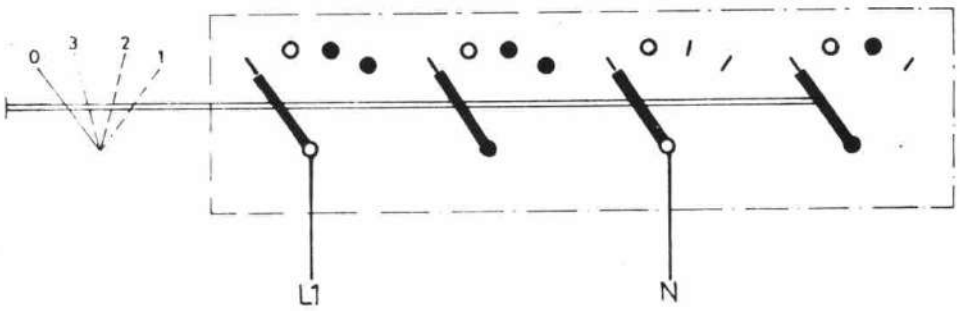
An electrical heater consists of two heating resistors of 1000 W each and one fan motor. The 4 - step - switch has to make the following connections:

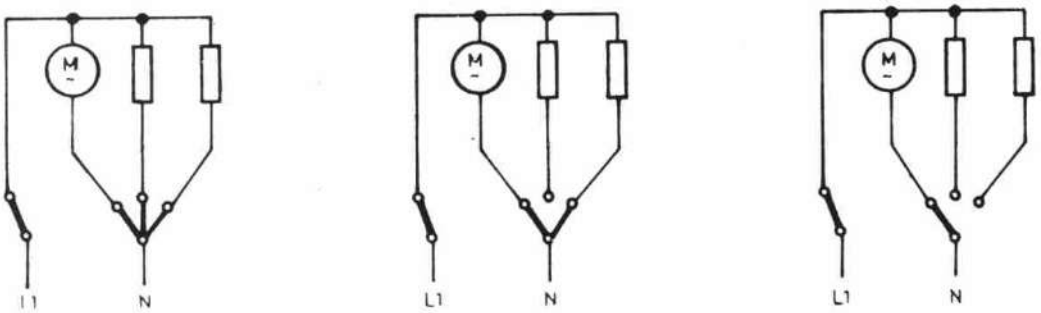
step 0: off step 3: fan motor & 2000 W heating power
step 2: fan motor & 1000 W heating power
step 1: fan motor

Draw the diagram of the internal connection in the heater according to the given layout diagrams.





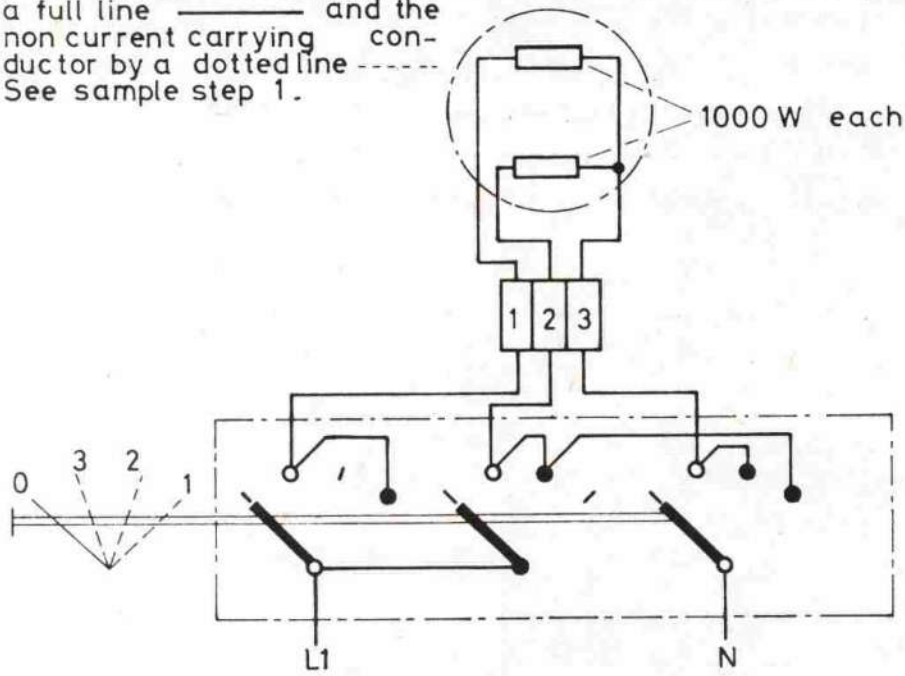


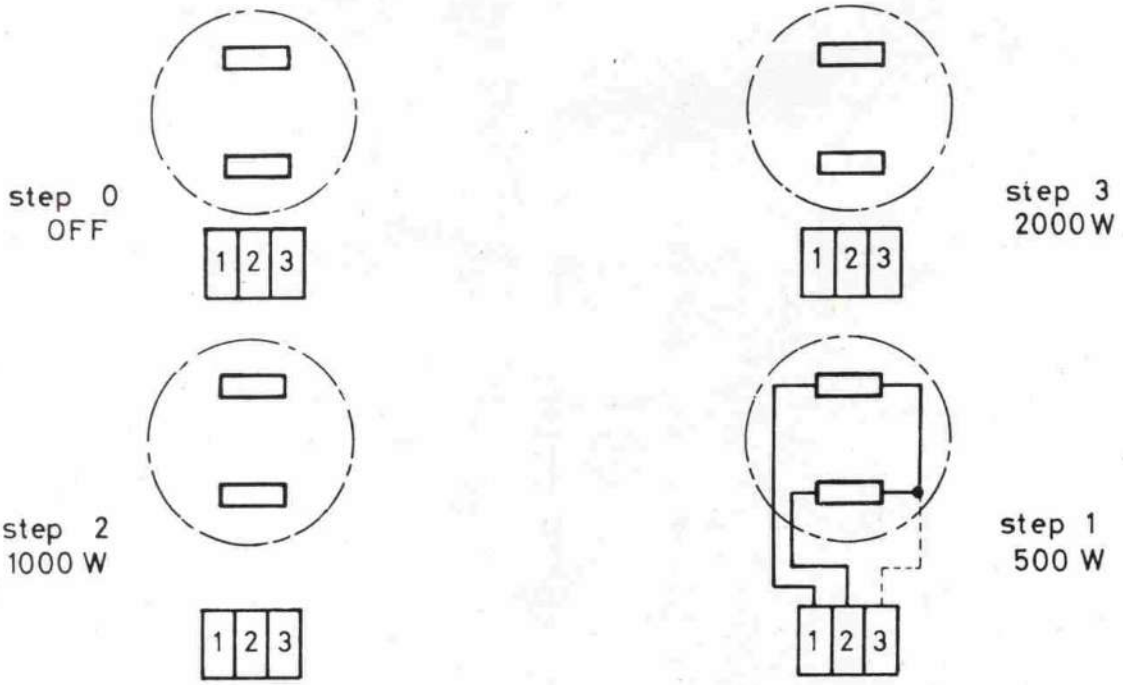


	ELECTRIC HEATER WIRING	TECHNICAL DRG. No. 43
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

COMPLETE THE CIRCINTS

The heating power of a hotplate of 2000 W is being controlled by a 4 - step - switch. Draw the connections from the heating resistances to the switch terminals according to the required power consumption.
For switch positions 2, 3 and 0 indicate the current carrying conductors by a full line ——— and the non current carrying conductor by a dotted line ------
See sample step 1.





	HOT PLATE WIRING	TECHNICAL DRG. No. 44
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

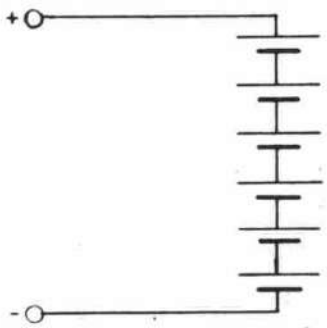
To provide different DC supply voltages and different discharging currents, cells may be connected to batteries of various types according to the requirements.

To meet the demands specified underneath lead storage batteries may be used with a voltage of 2V per cell and an average discharging current of 4A.

Draw the connection diagrams for the following batteries.

a) 12V, 4A
b) 6V, 16A
c) 10V, 8A
d) 22V, 12A

a)



b)

c)

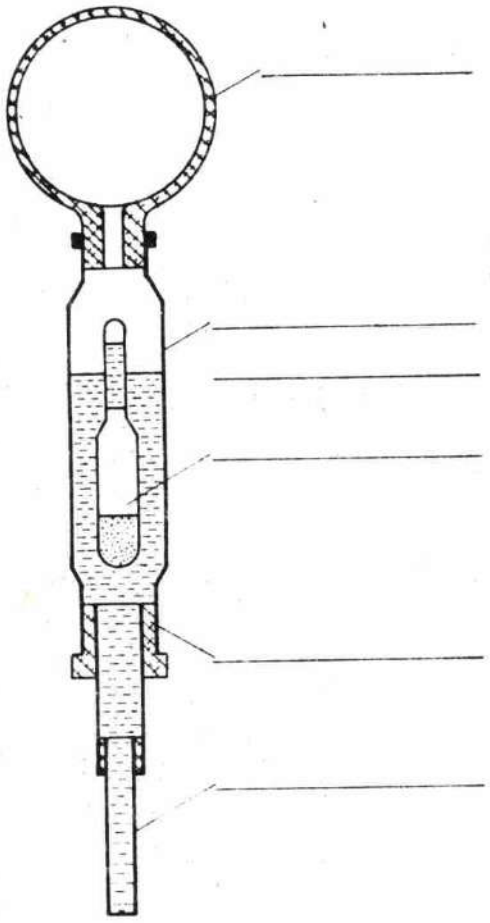
d)

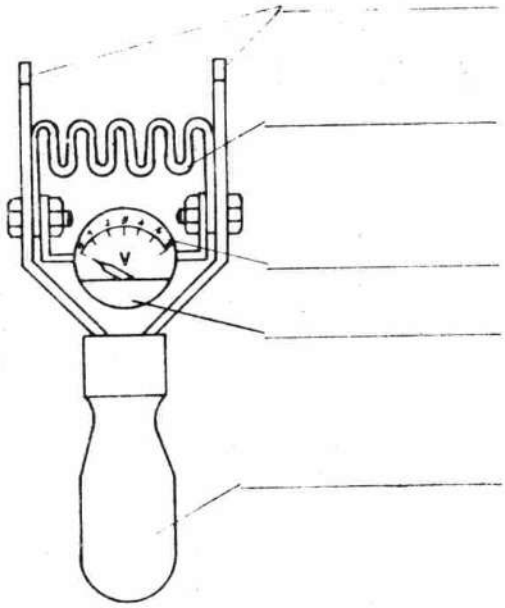
CONNECTION OF CELLS
FOR DIFFERENT CURRENTS AND VOLTAGES

TECHNICAL DRG. No. 45

To indicate the different parts of the battery testing devices fill in the blanks using the given terms:

Test Rods	Floating bulb	Hydrometer
Rubber Stopper	Scale	Nozzle
Shunt Resistor	Hydrometer Syringe	Voltmeter
Rubber Bulb	Voltage Tester	Handle





BATTERY TESTING DEVICES

TECHNICAL DRG. No. 46

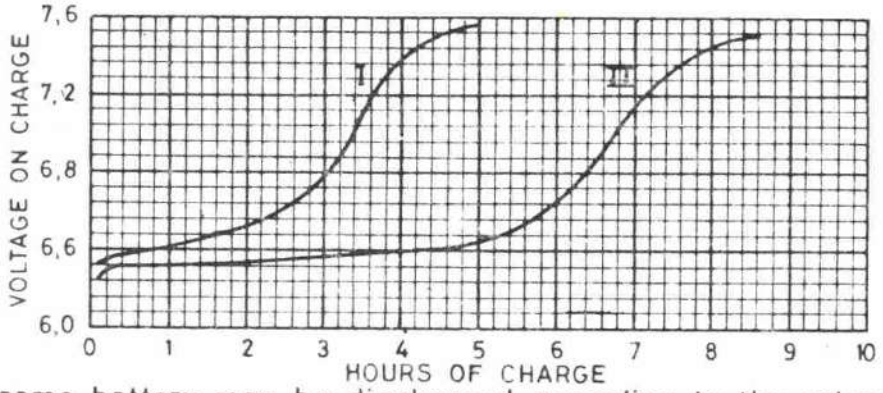
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

For a lead storage battery of 6V rated voltage and 84 Ah capacity two charging curves are shown below.

I : Fast charging , II : Nominal rate charging.

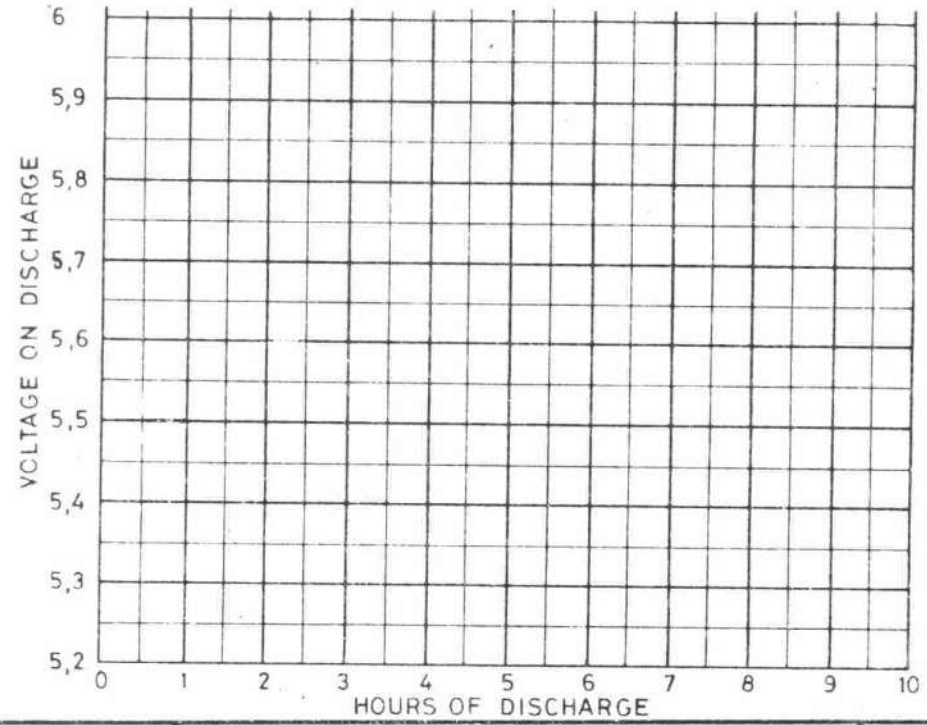


The same battery may be discharged according to the values of the table below with discharging currents

I : 8,4A , II : 14A

Plot the discharging characteristic curves

TIME		$\frac{1}{4}$ h	$\frac{1}{2}$ h	$\frac{3}{4}$ h	1 h	2 h	3 h	4 h	5 h	6 h	7 h	8 h	9 h	10 h
VOLTAGE	I	6,05	6	6	6	6	6	6	6	5,98	5,94	5,89	5,81	5,66
	II	5,93	5,9	5,89	5,88	5,85	5,8	5,69	5,48	5,20	—	—	—	—

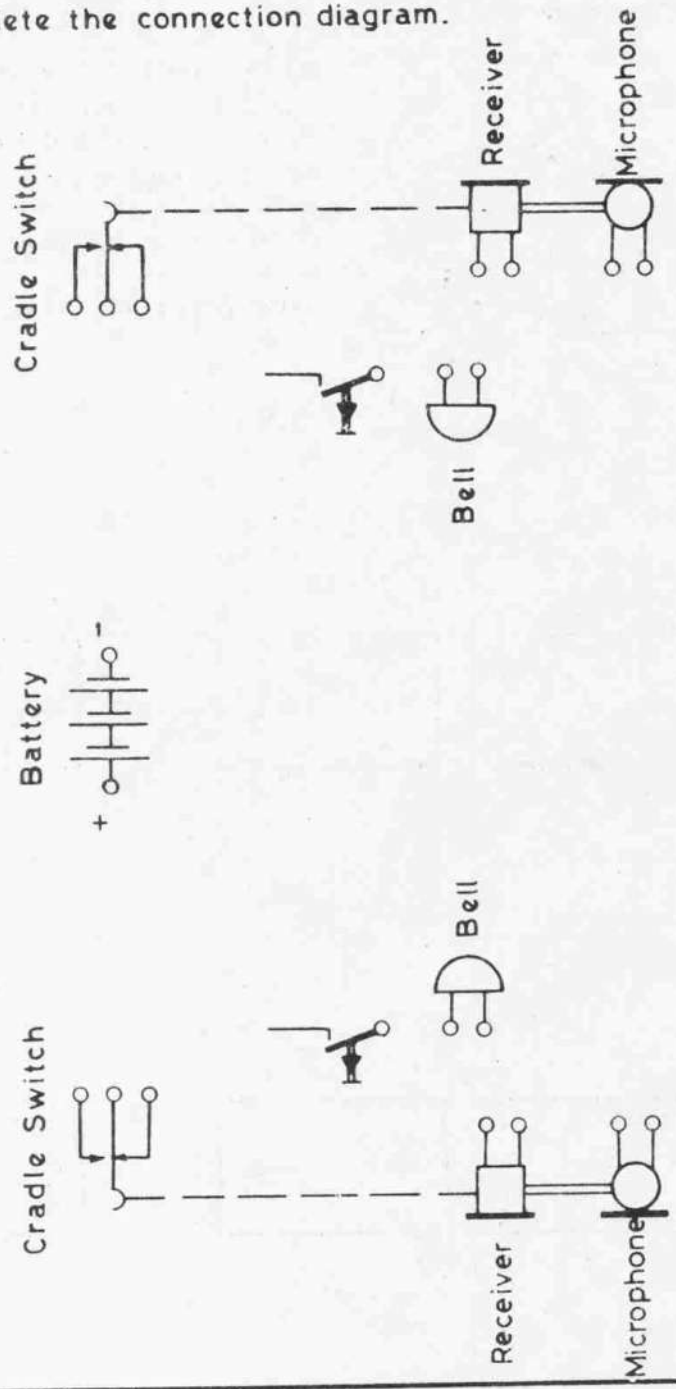


CHARGING AND DISCHARGING CHARACTERISTIC CURVES

TECHNICAL DRG. No. 47

In the intercommunication set with mutual call-circuits there is a cradle switch in both parts. With the receiver unhooked, the talk-circuit is made but the call-circuit is interrupted.

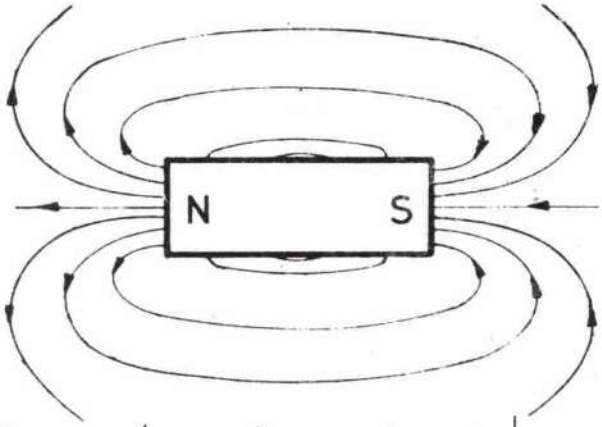
Complete the connection diagram.



	INTERCOMMUNICATION SET WITH BATTERIES	TECHNICAL DRG. No. 48
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

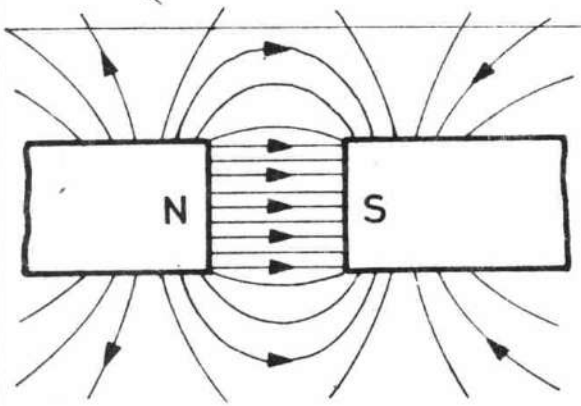
PLOT THE MAGNETIC LINES OF FORCES.

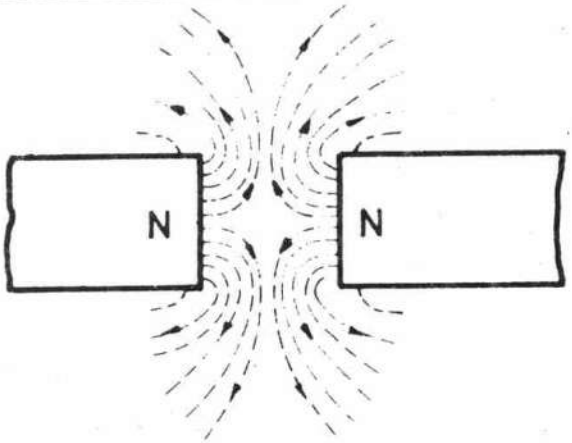
Magnetic lines of forces are closed lines.
It is defined that the internal magnetic lines of forces of a magnet run from south pole to north pole and the external magnetic lines of forces run from north pole to south pole.

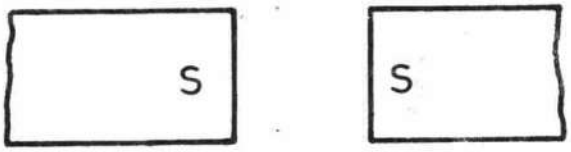


At the poles the magnetic field is the strongest that means the field density is the highest.

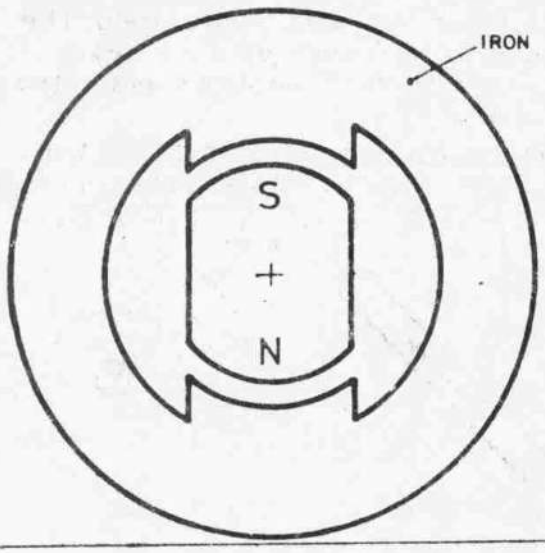
Unlike poles attract each other.
Like poles repel each other.

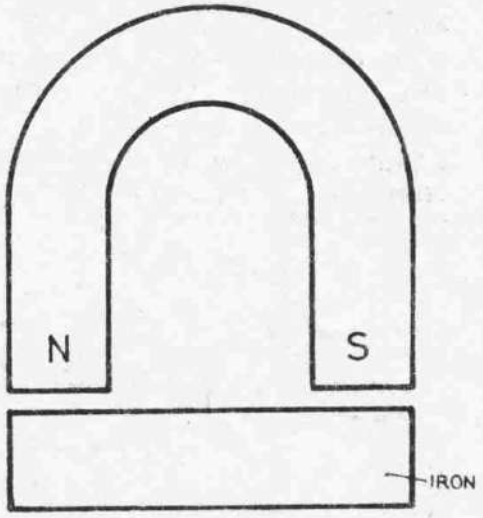


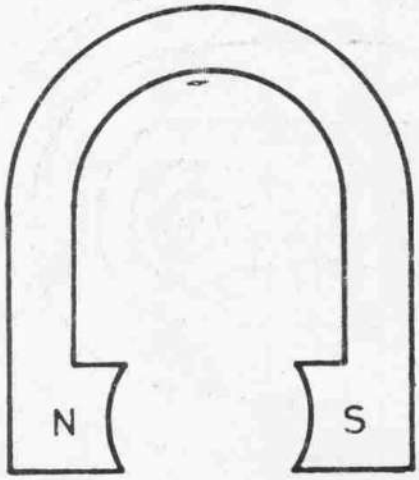


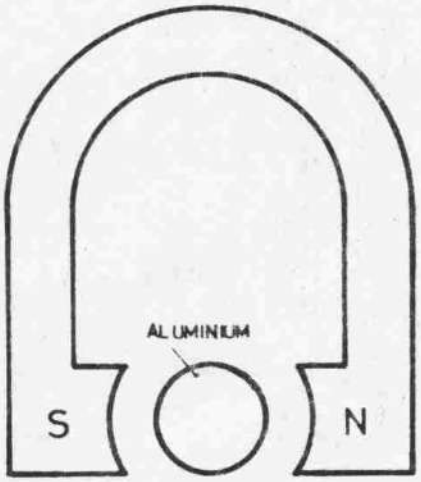


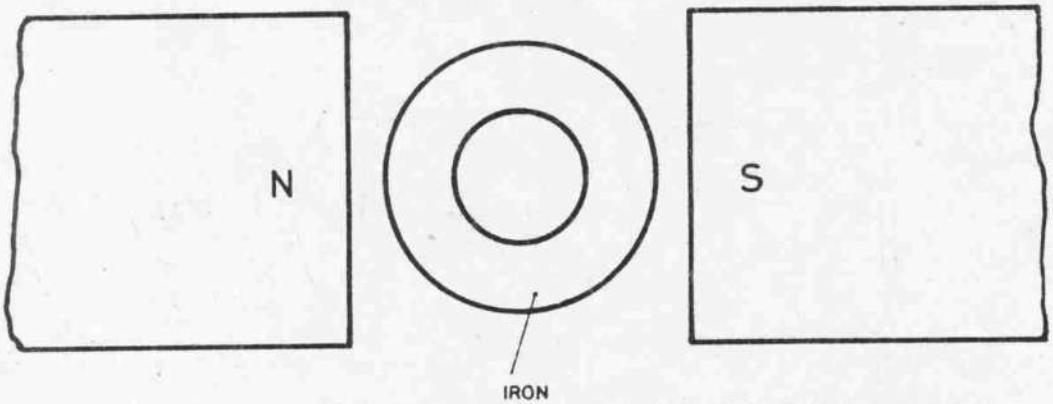
	MAGNETIC LINES OF FORCES OF A PERMANENT MAGNET	TECHNICAL DRG. No. 49
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL











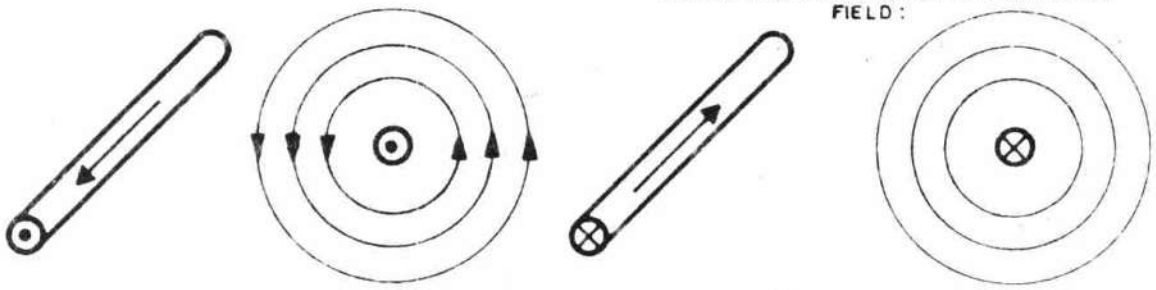
PLOT THE MAGNETIC LINES OF FORCES, GENERATED BY THE MAGNETS !

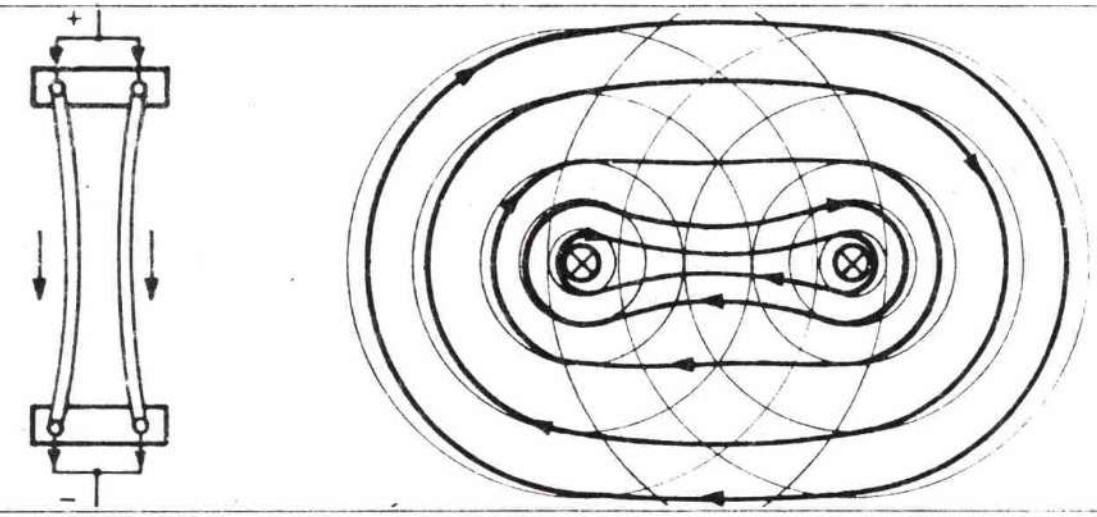
	MAGNETIC LINES OF FORCES OF A PERMANENT MAGNET	TECHNICAL DRG. No. 50
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

PLOT THE MAGNTIC LINES OF FORCES.

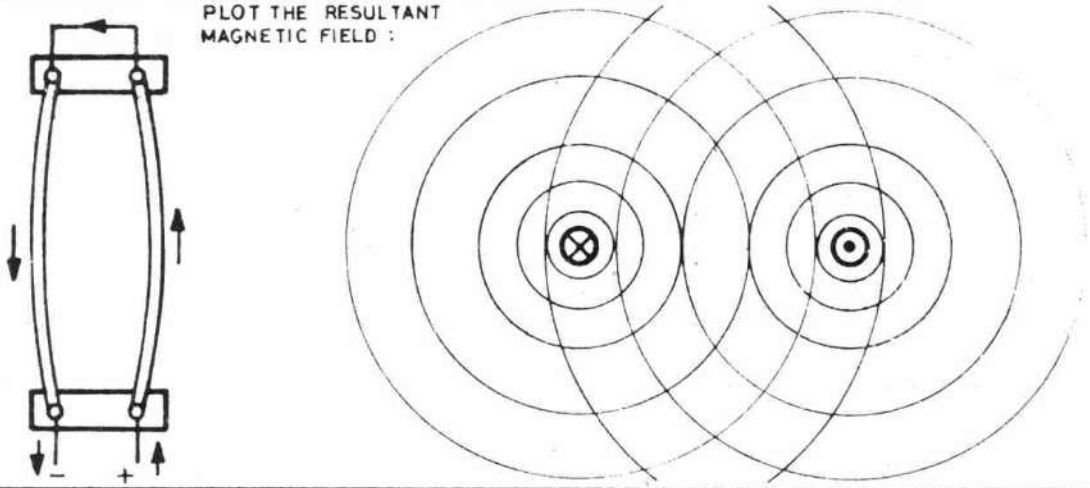
Around a current carrying conductor there is a magnetic field. The magnetic lines of forces have the shape of concentric circles.
The direction of the magnetic lines of forces depends upon the direction of the current.
Equal direction of current in parallel conductors effects attraction
opposite direction of current in parallel conductors effects repulsion

ENTER THE DIRECTION OF THE MAGNETIC FIELD :



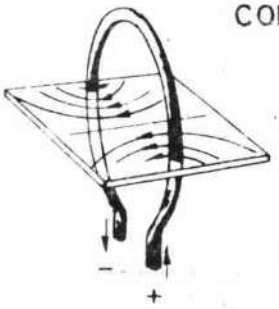


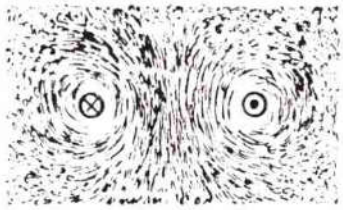
PLOT THE RESULTANT MAGNETIC FIELD :



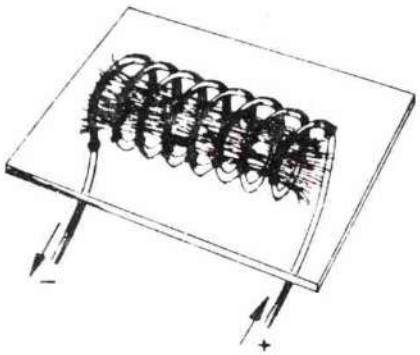
	MAGNETIC LINES OF FORCES OF A CURRENT CARRYING CONDUCTOR	TECHNICAL DRG. No. 51
	DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME	ELECTRICIAN GENERAL

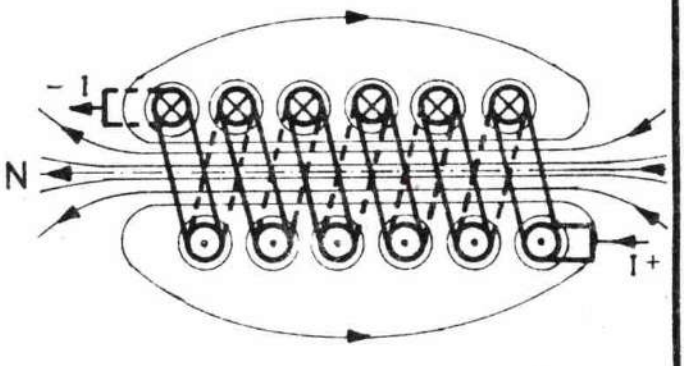
COIL OF 1 TURN



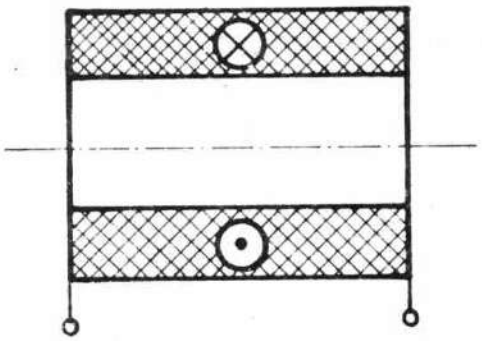


COIL OF 6 TURNS

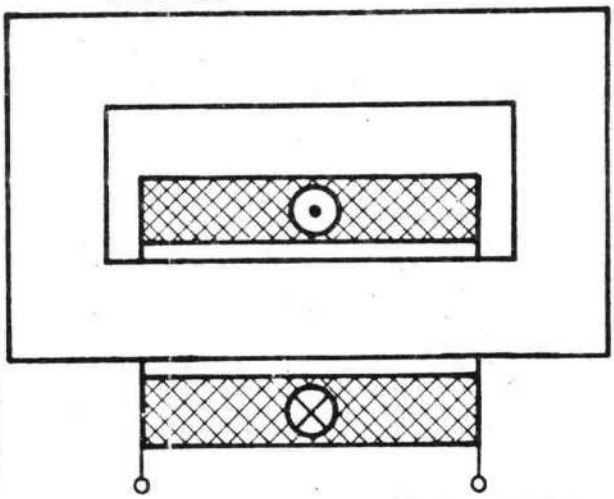




The internal magnetic field of a coil is a homogeneous field as a result of the magnetic lines of forces of all turns.

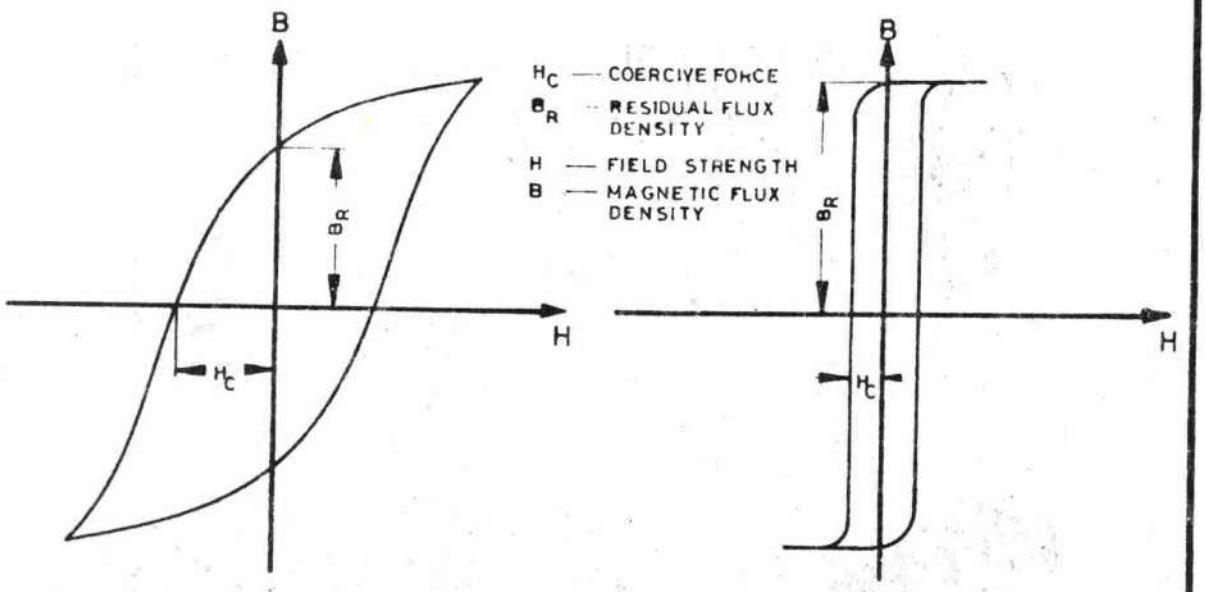


IRON CORE

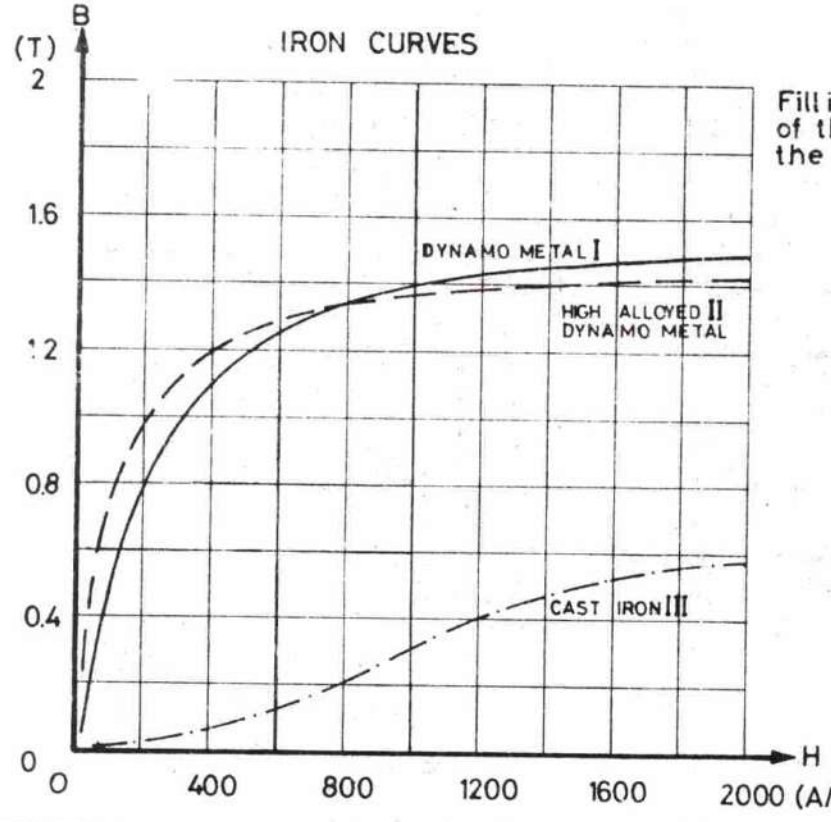


PLOT THE MAGNETIC LINES OF FORCES GENERATED BY THE CURRENT CARRYING COIL!

	MAGNETIC LINES OF FORCES OF A CURRENT CARRYING COIL	TECHNICAL DRG No. 52
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



MAGNETIC HYSTERESIS LOOP



Fill in the missing values of the table according to the given iron curves

Curve I

H (A/m)	B(T)
	1.4
800	
	0.8

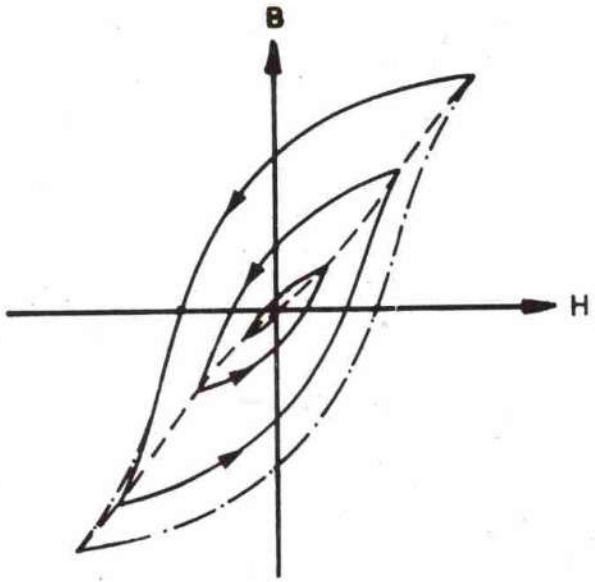
Curve II

H(A/m)	B(T)
	1.4
400	
2000	

Curve III

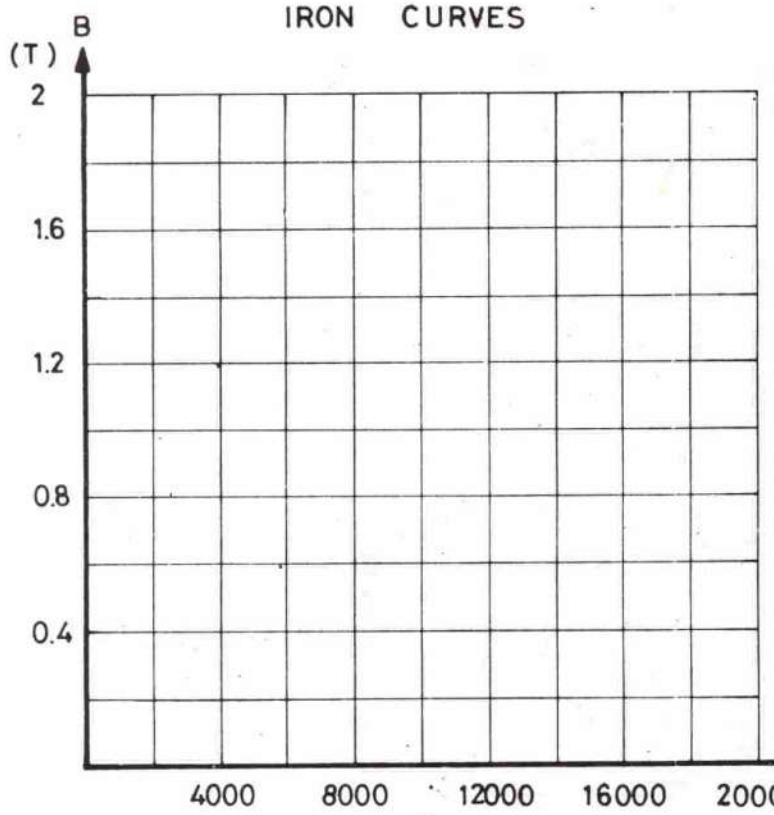
H(A/m)	B(T)
	0.2
1200	
	0.5

	MAGNETIZING CURVES	TECHNICAL DRG. No. 53
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



MAGNETIC HYSTERESIS LOOP OF DEMAGNETIZATION

IRON CURVES



Draw the iron curves according to the given values in the table:

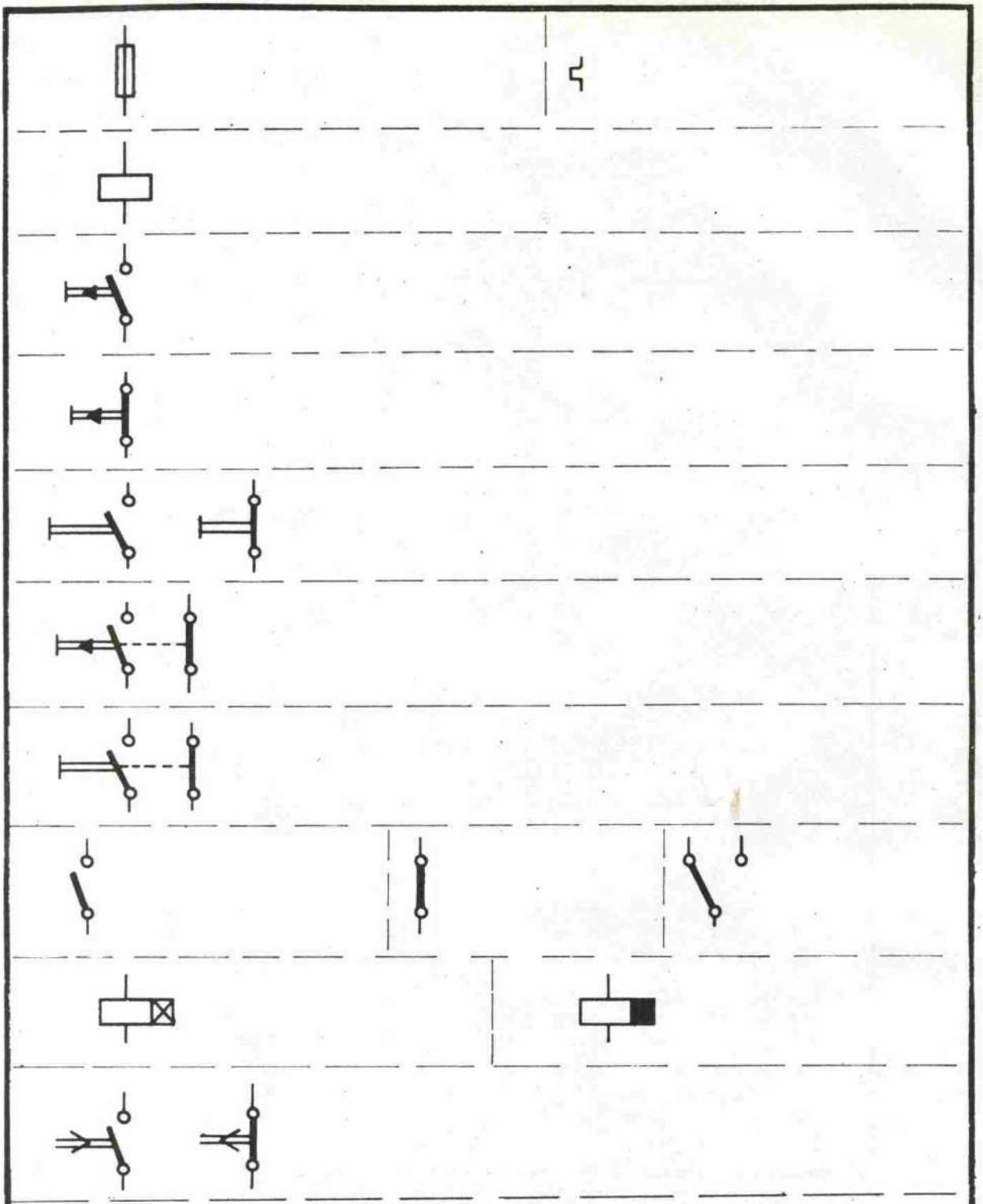
	H(A/m)	B(T)
dynamo metal	1000	1.35
	2000	1.5
	4000	1.6
	8000	1.7
	11000	1.76
	14000	1.8
	20000	1.85
cast iron	1000	0.3
	2000	0.6
	4000	0.75
	7500	0.9
	11000	1
	15000	1.1
	20000	1.2

MAGNETIZING CURVES

TECHNICAL DRG. No. 54

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME



GIVE IN BRIEF THE MEANING OF THE SYMBOLS

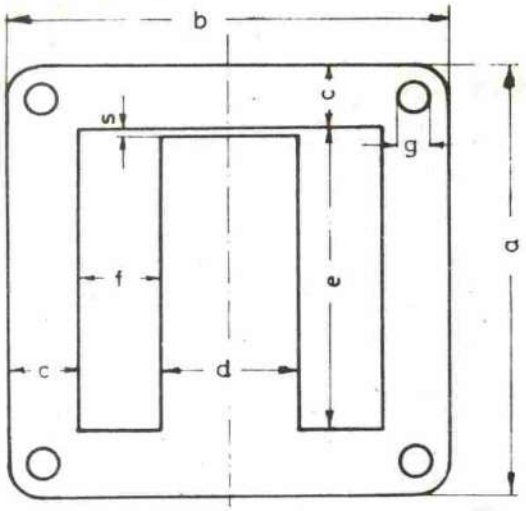
CONTACTORS & RELAYS
SYMBOLS

TECHNICAL DRG.
No. 55

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

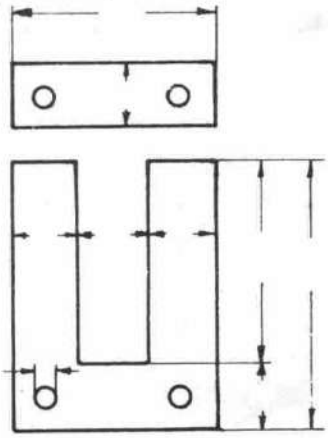
ELECTRICIAN
GENERAL



M-TYPE

	a	b	c	d	e	f	g
M 20	20	20	3,5	5	13	4	2,8
M 30	30	30	5	7	20	6,5	3
M 42	42	42	6	12	30	9	3,5
M 55	55	55	8,5	17	38	10,5	3,5
M 65	65	65	10	20	45	12,5	4,5
M 74	74	74	11,5	23	51	14	4,5
M 85	85	85	14,5	29	56	13,5	4,5
M 102	102	102	17	34	68	17	5,5

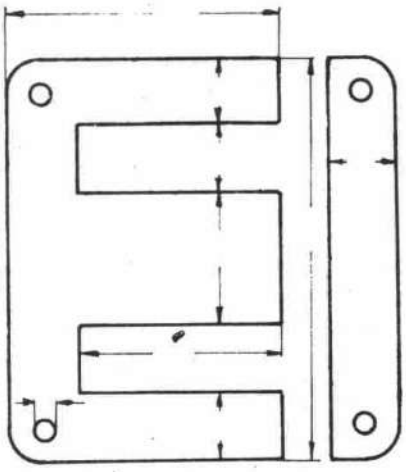
NAME THE TYPE OF THIS IRON CORE.



U-I- TYPE

	a	b	c	d	e	f	g
UI 30	40	30	10	10	30	10	3,5
UI 39	52	39	13	13	39	13	3,5
UI 48	64	48	16	16	48	16	4,5
UI 60	80	60	20	20	60	20	4,5
UI 75	100	75	25	25	75	25	5,5
UI 90	120	90	30	30	90	30	7,8
UI 102	136	102	34	34	102	34	7,8
UI 114	152	114	38	38	114	38	11,0

FILL IN THE DIMENSIONS. IRON CORE: _____



E-I-TYPE

	a	b	c	d	e	f	g
EI 48	48	32	8	16	24	8	3,5
EI 54	54	36	9	18	27	9	3,5
EI 60	60	40	10	20	30	10	3,5
EI 66	66	44	11	22	33	11	4,5
EI 78	78	52	13	26	39	13	4,5
EI 84	84	56	14	28	42	14	4,5
EI 92	92	62,5	11,5	23	51	23	4,5
EI 106	106	70,5	14,5	29	56	24	5,5
EI 130	130	87,5	17,5	35	70	30	6,8
EI 150	150	100	20	40	80	35	7,8
EI 170	170	117,5	22,5	45	95	40	8
EI 195	195	152,5	27,5	55	125	42,5	11

FILL IN THE DIMENSIONS. IRON CORE: _____

SELECTION ONLY	CONSTRUCTION OF TRANSFORMER IRON CORE TYPES	TECHNICAL DRG. No. 56

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

transformer

auto transformer

tapped transformer

COMPLETE THE WINDINGS.

variable transformer

COMPLETE THE WINDINGS.

CONSTRUCTION OF TRANSFORMER —WINDING

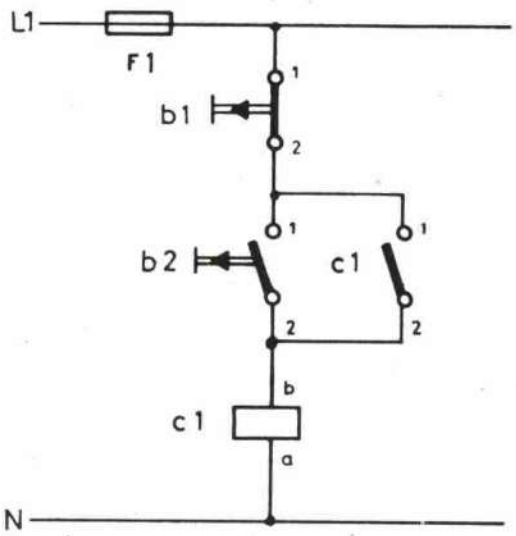
TECHNICAL DRG. No. 57

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

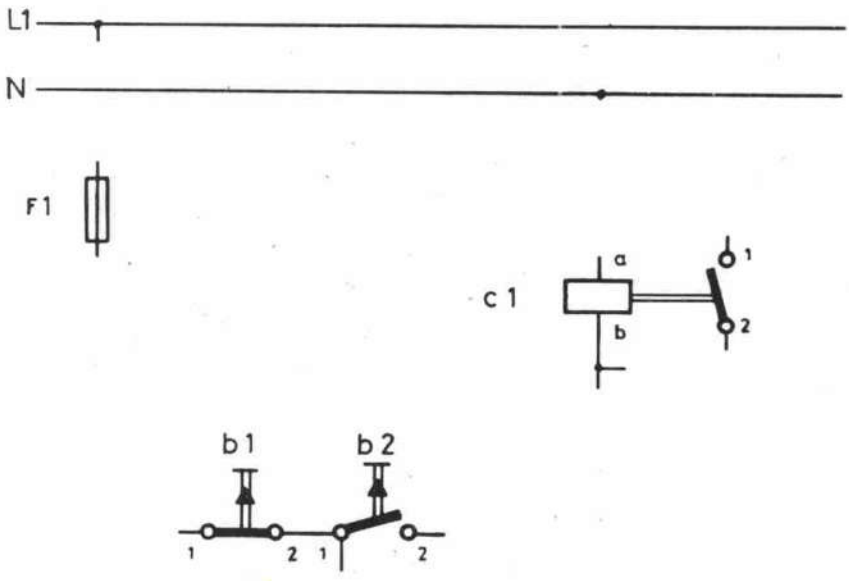
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

CURRENT PATH DIAGRAM



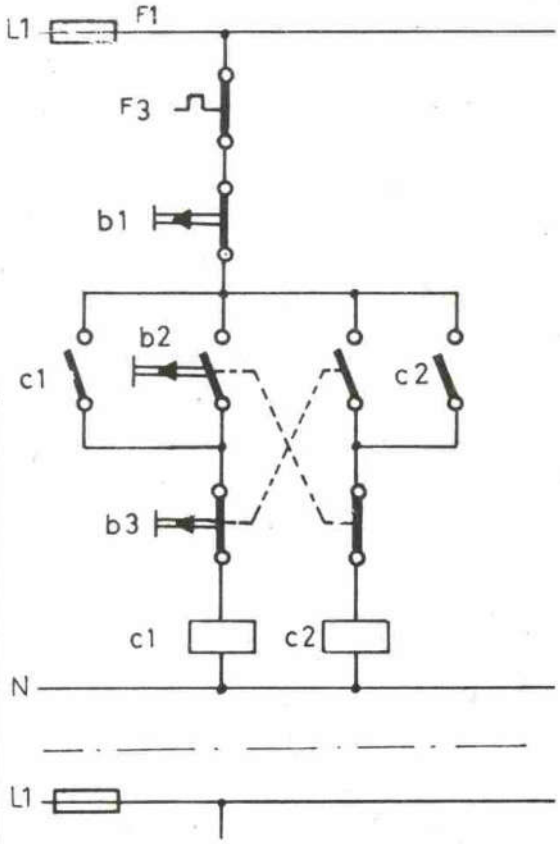
WIRING DIAGRAM



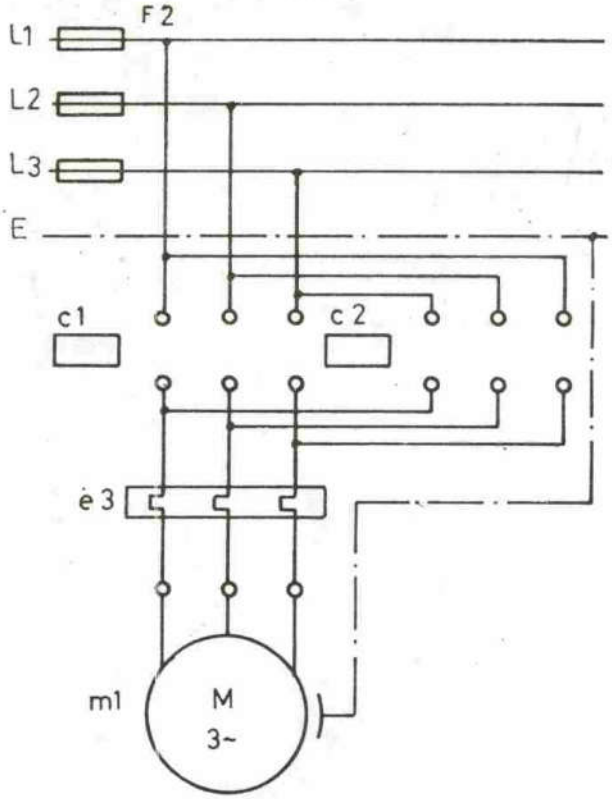
COMPLETE THE WIRING DIAGRAM ACCORDING TO THE GIVEN CURRENT PATH DIAGRAM.

	ON- AND OFF CIRCUIT WITH CONTACTOR	TECHNICAL DRG. No. 58
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

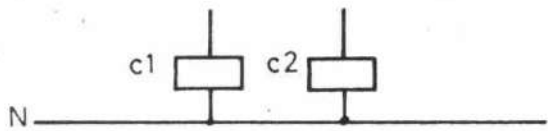
CONTROL CIRCUIT



POWER CIRCUIT



DRAW THE CURRENT PATH DIAGRAM OF THE CONTROL CIRCUIT IN THAT CONDITION THAT b2 HAS BEEN PRESSED AND RELEASED.
FILL IN THE POSITION OF SWITCHES IN THE POWER CIRCUIT ACCORDING TO THE DEVELOPED CONTROL CIRCUIT.



INTERLOCKING BY PUSH BUTTON CONTACTS

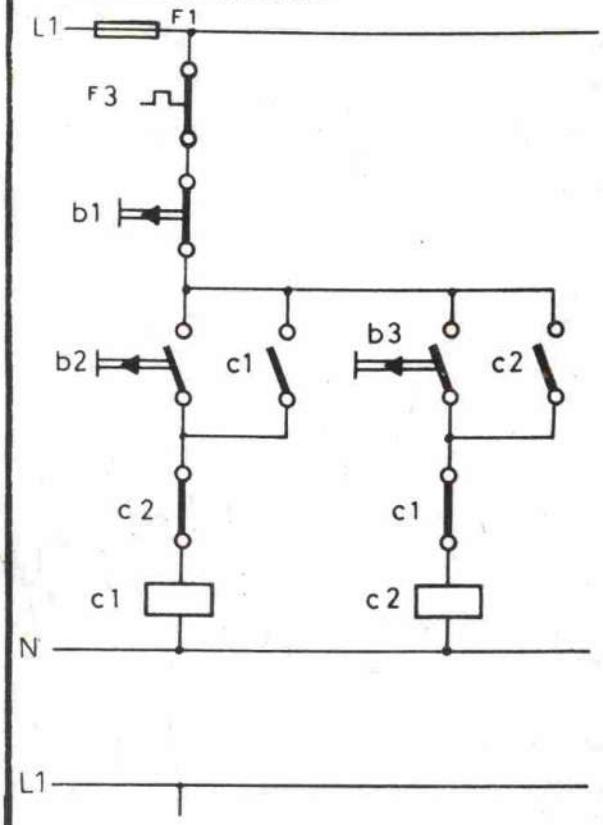
TECHNICAL DRG. No. 59

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

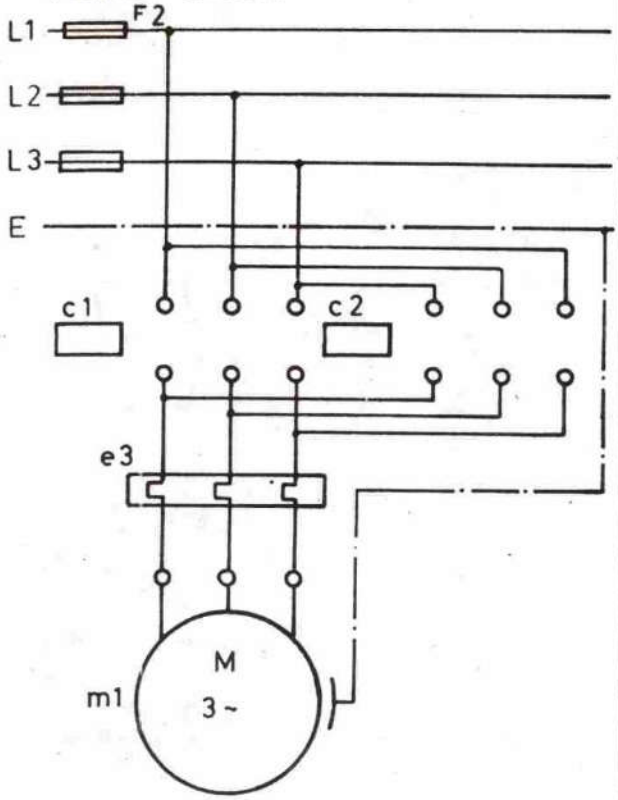
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

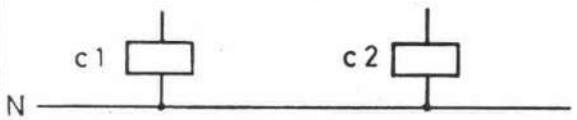
CONTROL CIRCUIT



POWER CIRCUIT



DRAW THE CURRENT PATH DIAGRAM OF THE CONTROL CIRCUIT IN THAT CONDITION THAT b3 HAS BEEN PRESSED AND RELEASED.
ALSO FILL IN THE POSITION OF SWITCHES IN THE POWER CIRCUIT ACCORDING TO THE DEVELOPED CONTROL CIRCUIT.



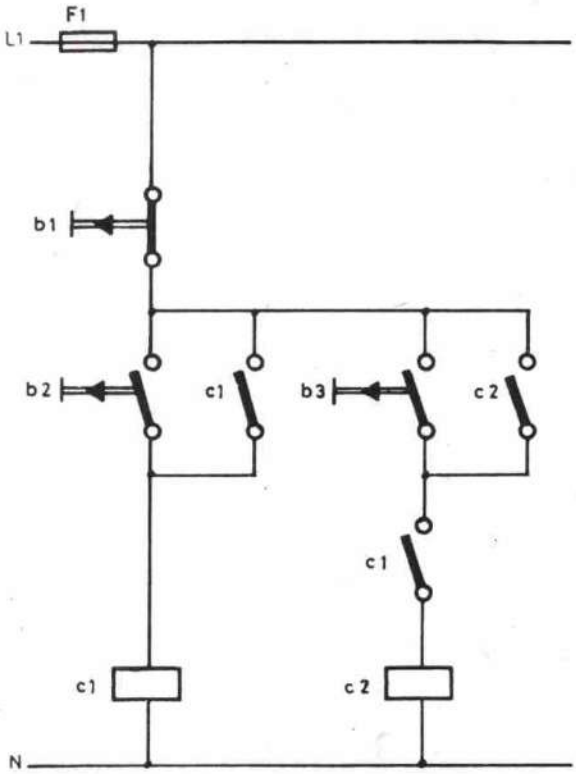
	INTERLOCKING BY CONTACTORS	TECHNICAL DRG. No. 60

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

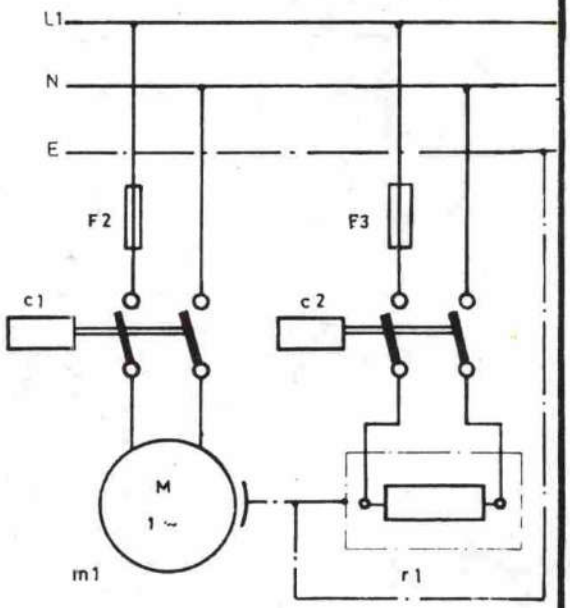
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

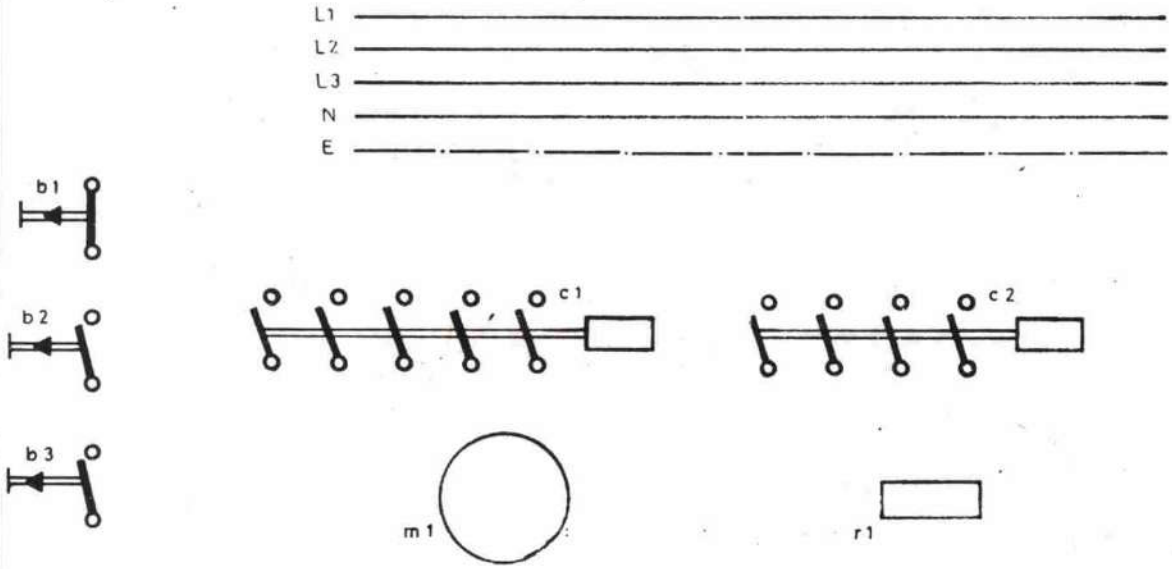
CONTROL CIRCUIT



POWER CIRCUIT



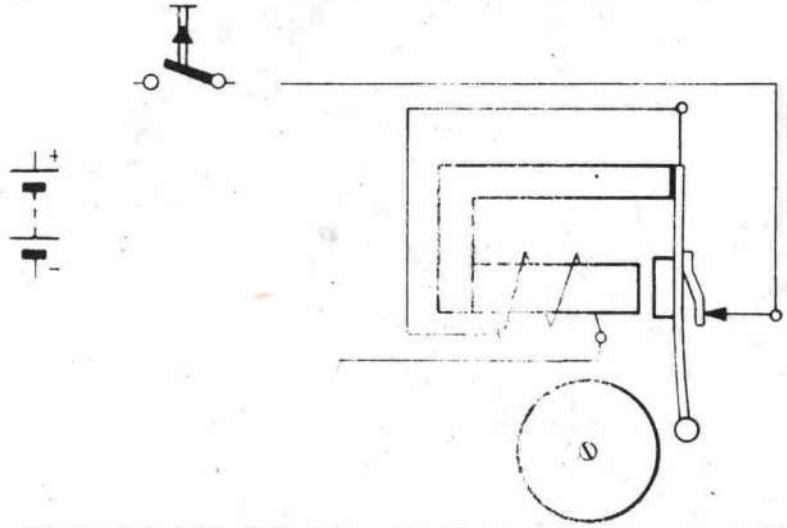
WIRING DIAGRAM



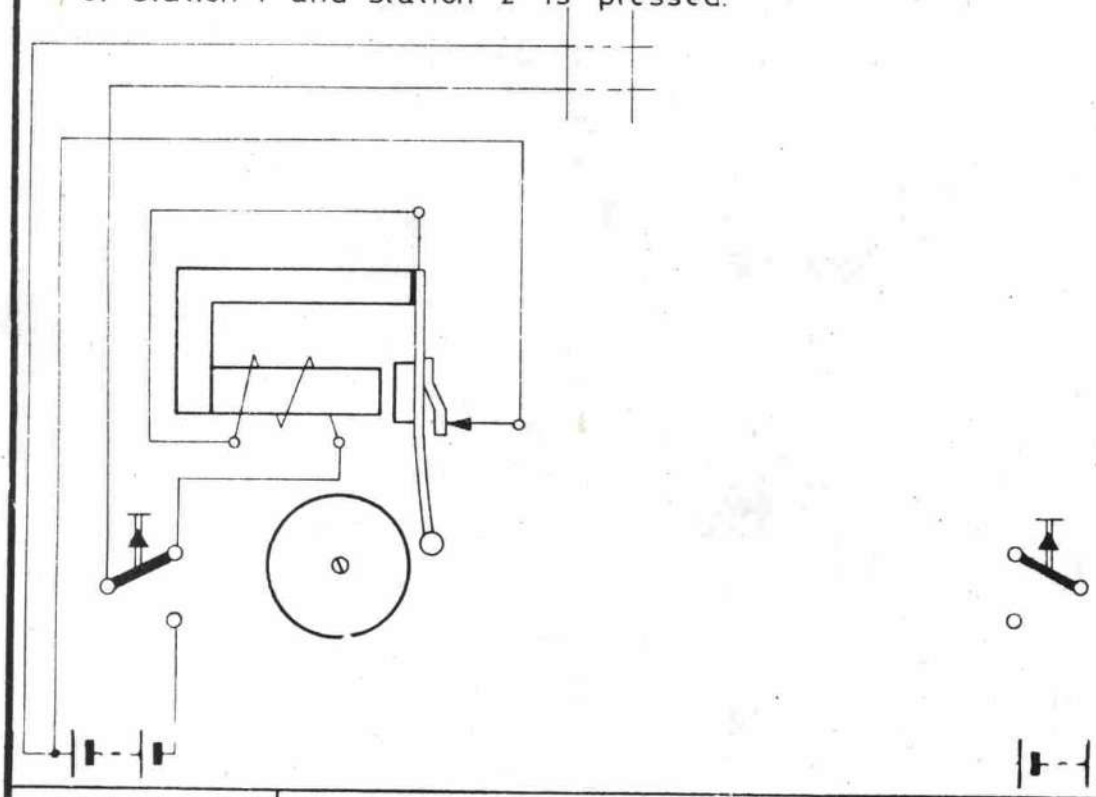
COMPLETE THE WIRING DIAGRAM ACCORDING TO THE GIVEN CURRENT PATH DIAGRAMS OF THE CONTROL AND POWER CIRCUIT.

	SEQUENCE CONTROL HAND DRIVEN	TECHNICAL DRG. No. 61
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL

The bell is ringing as long as the push button is being pressed.
Complete the circuit and explain the working principle of the bell.



Draw the wiring diagram of a corresponding call set for 2 stations.
The set consists of 1 bell, 1 battery & 1 change over switch each. Only 2 wires are required as connections between station 1 and station 2.
Discuss the current path when push button (that is change over switch) of station 1 and station 2 is pressed.



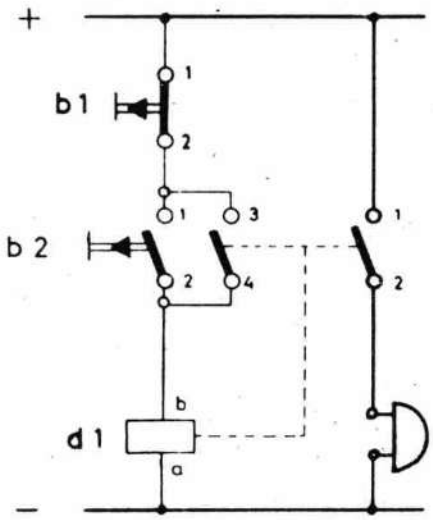
BELL CIRCUIT

TECHNICAL DRG.
No. 62

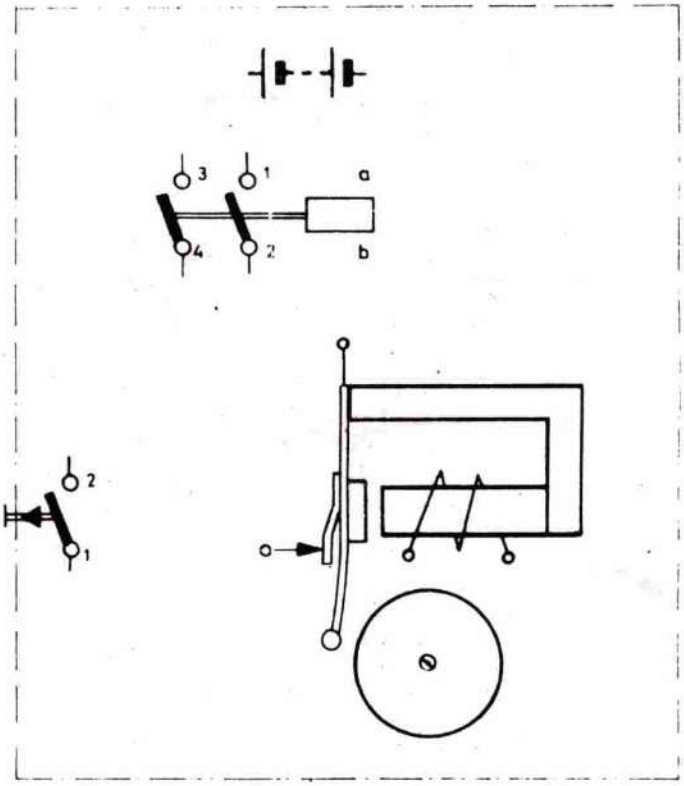
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

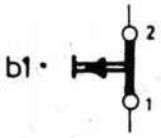
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL



Below the wiring diagram is to be drawn according to the given current path diagram. Discuss the function of that connection.





BELL CIRCUIT

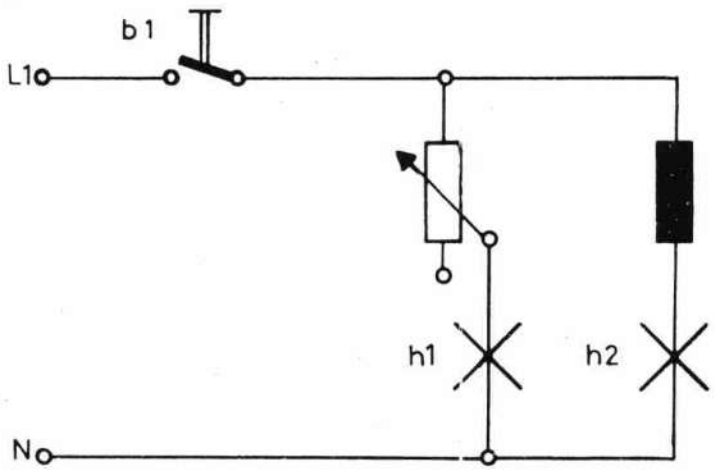
TECHNICAL DRG. No. 63

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

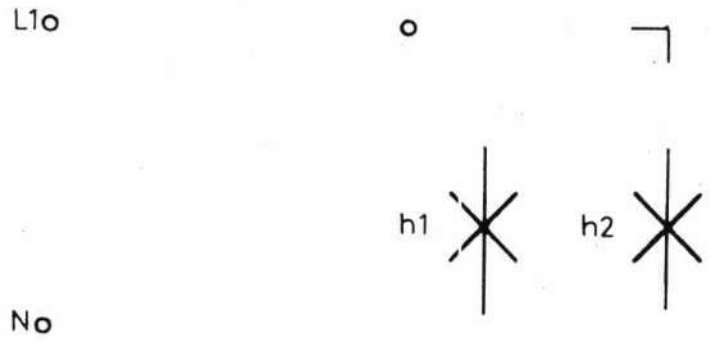
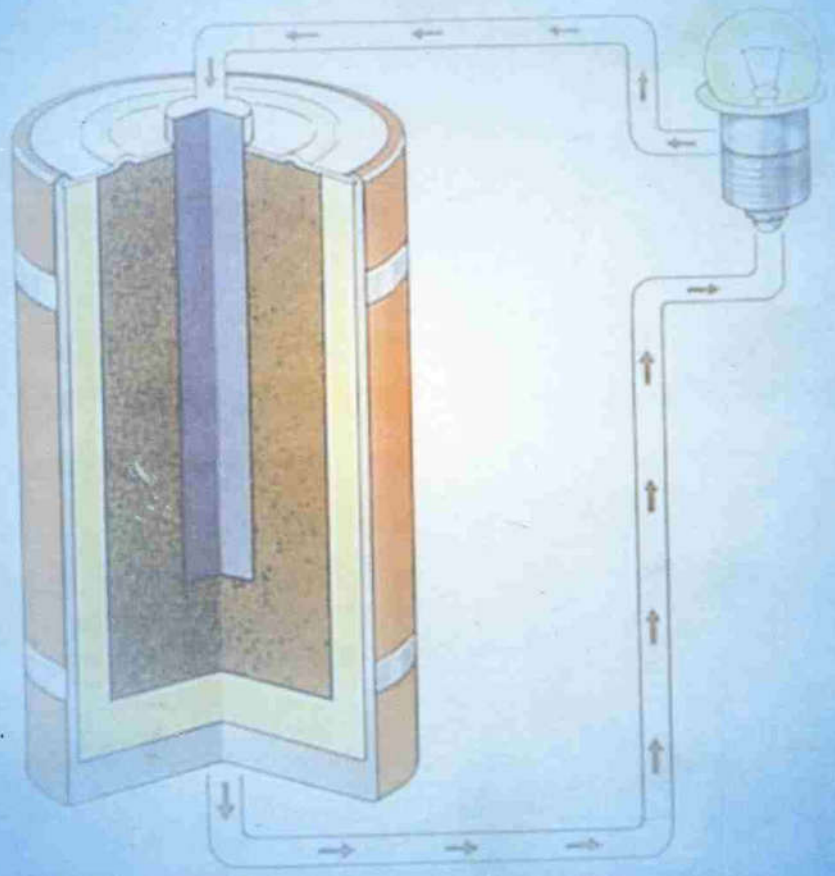
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

1) After closing the circuit by b1 lamp h1 illumes immediately and h2 delayed.
Give in brief the reasons for this.



2) The effect of delay can be increased by using an inductor with iron core. Draw the circuit.



	DIAGRAMS with INDUCTANCES	TECHNICAL DRG No. 64
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL